THURSDAY, FEBRUARY 17, 1876

THE LISBON MAGNETIC OBSERVATIONS

Annaes do Observatorio do Infanto D. Luiz. Magnetismo Terrestre. Lisbon Imprensa Nacional. (1870, 1874.)

THAT in 1858 Portugal entered into "the Magnetic Union of Nations, founded by Gauss and by Humboldt in 1832," was due to the enlightened solicitude of the King Luiz I. for the progress of science. The observatory founded by him at Lisbon, and placed under the care of the late Mr. de Silviera, has during the last few years been directed by Mr. de Brito Capello, who had previously the oversight of the magnetic department, and to whom we believe the results in the two parts of Annals before us are chiefly due.

The value of the Lisbon observations and of these results is so much the greater that the neighbouring country, Spain, has done nothing for terrestrial magnetism, and even France, which stands so high in science, has given us no such series of observations since Arago originated them by the devotion of years to the movement of the magnetic needle.

The first part of the Annals before us (1870) treats of the results for the magnetic declination derived from direct observations made at 8 A.M. and 2 P.M. (1858-1868), and for the diurnal variations (1864-1868) from a photographic registering apparatus similar to that at Kew. The secular variation is first investigated. This mysterious movement, which we can attribute to no known cause, as it has no known period, is shown at Lisbon by a mean approach of the north end of the needle to the north at the rate of 5″·9 a year during ten years, but varying from a minimum of 4′·8 in 1858-9, to 8′·2 in 1866-7. An annual law has also been found consisting of an oscillation of 1′·5, the needle being nearest the north in June, and farthest from it in December and January.

The diurnal variation at Lisbon resembles to a considerable extent that obtained at more northern stations in Europe. The periodic variation of the mean range of this oscillation, first discovered by Dr. Lamont, which occupies from ten to twelve years, has also been found at Lisbon. This investigation has its importance increased by the fact that the greatest and least mean oscillations happen at the same times as the maximum and minimum frequency of solar spots. The coincidence first indicated by Sir E. Sabine, with reference to magnetic disturbances, was remarked independently by Dr. Rudolph Wolf, of Zurich, who has made it the subject of an extensive and valuable series of investigations. Dr. Lamont, commencing with Cassini's observations, has found the mean duration of the magnetic period to be 10·43 years, while Dr. Wolf obtains 11·11 years from a longer, though perhaps less certain, series of solar spot observations. Since there can be no doubt that the yearly variation of sunspots and of the amplitude of the diurnal oscillation of the magnetic needle follow the same law and depend on the same cause, every new determination of the epochs of maxima and minima is of value, fixing points which will determine the mean duration and variable length of the period, and thus probably lead us to a knowledge of the common cause. The Lisbon observations give 1859·9 and 1867·0 as epochs of maximum and minimum, agreeing very nearly with those derived from the Munich and Trevandrum observations. In the determination of the mean duration, everything depends on where we commence. If we begin with Arago's magnetic observations, the mean duration is about 10·7 years; if we take the most accurate results for the sunspot area from Messrs. De la Rue, Stewart, and Lœwy, we find 11·2 years, nearly that deduced by Dr. Wolf. Evidently a much longer series of accurate observations is required to determine the length of a period which has varied between 8 and 12·3 years within the last half century; though we believe Dr. Lamont's result to be nearly true.

As the Observatory establishment was not sufficient for the long calculations required for the investigations connected with the lunar diurnal variation, the latter was sought approximately from the effects of the lunar action in diminishing or increasing the solar diurnal oscillation at different days of the moon's age. It was thus found that the diurnal oscillation from 8 A.M. to 2 P.M. was greatest when the moon was three and eighteen days old, while it was least when she was ten and twenty-four days old. This indicates a semi-diurnal oscillation due to the moon's action, with an amplitude of 1′ nearly, having the maximum westerly positions when the moon is near the upper and lower meridians.

It is remarked by Mr. Capello, with reference to disturbances, that in many cases the observations taken as disturbed (those differing from the normal position by 2′·26 or more) were, properly speaking, not disturbed observations, but belonged to very regular curves, in which the morning minimum was more marked or the afternoon maximum was less so than usual. Whereas disturbances are shown by serrated curves. This remark is quite exact, and the fact becomes even more marked in lower latitudes. The investigation for the lunar variation just noticed will show one cause for this variation of the amplitude of the diurnal oscillation which is greater the greater the lunar action.

The second part of the Annals before us (1874) contains the discussions for the other magnetic elements. Mr. Capello finds, from nine years' observations, that the horizontal force of the earth's magnetism was greatest in July, least in September, with a secondary maximum in November, and minimum in February. This result depends on few observations, but approaches considerably to that obtained first at Makerstoun. The very marked minimum found for the month of September induced Mr. Capello to examine whether this might not be due to the action of disturbances, which in general diminish the earth's magnetic force; it results from this discussion that though the disturbances have a considerable effect in increasing the amplitude of the annual oscillation, yet the maximum in December is best marked in years of least disturbance. This result he confirms by an examination of the Kew observations, and it agrees with that deduced from each of a series of years' observations of the bifilar at Makerstoun. Mr. Capello also finds that the Munich observations show the most marked minimum in September and October, in years of least disturbance. It is an important fact, confirmed by the results from many observatories, that the horizontal force of the

earth's magnetism is a maximum near the solstices, and a minimum near the equinoxes.

The diurnal variations of horizontal force, deduced from the photographic registration of the bifilar magnetometer, follow laws similar to those at Munich, and not differing greatly from those at Makerstoun, 17° further north; the minimum, however, shifting from near 9 A.M. in summer to about 2 P.M. in winter.

The balance magnetometer seems to be the least certain of the variation instruments at Lisbon. The temperature coefficient (obtained by heating the air with gas jets) has been found with an opposite sign to that due to variations of the needle's magnetism, a result which is always unsatisfactory even when the variations of temperature are small as they are at Lisbon. The diurnal variation of the vertical magnetic force differs considerably from that obtained at more northern observatories, the minimum occurring in each month of the year near noon, and the maximum near 5 P.M.

Mr. Capello has evidently bestowed much pains on the determination of his instrumental constants, and this publication of results contains a valuable contribution to our knowledge of the magnetic laws for an important station, near the most southerly and westerly point in Europe. Lisbon, like nearly every other magnetic observatory, has been obliged to be satisfied with single instruments of each kind. When so many observatories were founded between thirty and forty years ago, there was perhaps an over confidence in the excellence of the instruments employed, and in the certitude of being able to correct the observations to be obtained from them for every possible error. There was also the economical consideration connected with the expense of a double series of instruments, as well as the additional labour incurred in observing two instruments for the same purpose. The consequence has been, to take a single illustration, that no two observatories have given exactly the same law for the annual variation of the mean position of the magnetic needle. One observatory has contradicted another, the results from a good instrument have been balanced by those from a bad one, and in other cases it has not been possible to determine whether the differences found at two stations were really due to difference of locality only, or to instrumental causes.

When we remember the vast labour (to omit every other consideration) expended in obtaining the laws of magnetic variations, it cannot be too much regretted that every observatory was not furnished with a double series of instruments, which would have shown by their agreement or disagreement the accuracy or error of the results obtained from them. In the case of disagreement the director of the observatory would have been warned that some error existed whose cause should be sought out. No preliminary trials can ensure that an instrument will remain with exactly the same errors. If we could suppose that the captain of a ship would set sail on a lengthy and costly voyage with a single chronometer, without any means of verifying the accuracy of its going except the meeting with another ship in a like predicament, and should then find that, according to their chronometers, they were on opposite sides of the globe, we should have a parallel to a not uncommon case in the work of many magnetic observatories.

It is to be hoped for the future that such differences will not be allowed to exist, that each observatory will have the means of proving that, for its locality at least, the laws obtained are true, and that in publishing the observations, the differences of the indications of two instruments of each kind will be given with the most complete exposure of their errors and corrections.

JOHN ALLAN BROUN

MARSDEN'S "NUMISMATA ORIENTALIA"

Marsden's International Numismata Orientalia. Part II. Coins of the Ursuki Turkomans. By Stanley Lane Poole, Corpus Christi College, Oxford. (London: Trübner and Co., 1876.)

THIS is the second part of the series of separate publications on the Early Coins of the East, of which the first part on Ancient Indian Weights was reviewed in NATURE, vol. xii. p. 24. The whole work is intended to be a new edition of Marsden's "Numismata Orientalia," but in consequence of the new form of the work and its enlarged character, the editor has changed its title into that of the "International Numismata Orientalia."

Part II. has been undertaken by Mr. Stanley Lane Poole, and treats of the Coins of the Ursuki dynasty. Ursuk was one of the petty chiefs of Syria during the wars of the Crusades, in which he distinguished himself, and was made Governor of Jerusalem, A.D. 1086. His descendants, the Ursuki princes, were amongst the most powerful chiefs in Syria and Mesopotamia, until the dynasty was brought to a close by the Tartar invaders, A.D. 1242. An historical sketch of the Ursuki family is given by Mr. Poole as an introduction to the account of their coins.

The series of Ursuki coins described in the work, the greater part of which are now in the British Museum, are mostly copper coins, a few only being of silver. Several plates with clear lithographic and photographic representations of the coins form part of the work. The coins all bear Arabic inscriptions, some of considerable length, and they appear to be of much historical value. In the description of the several coins in the text of the work the old Arabic inscriptions on each coin are given in the more modern Arabic character, according to the system of transliteration adopted in the book. These inscriptions are, however, intelligible only to Arabic scholars, as no English translation is given, which would have added considerably to the interest of the work for general readers.

At the commencement of the Ursuki dynasty the Mahometan moneys were of three classes—gold, silver, and copper, the respective units being the *dinar*, *dirhem*, and *fels*. But the Ursuki coins, both copper and silver, appear to be *dirhems*, this word appearing in the inscription of many of the coins, and showing that they were intended to pass as *dirhems*. Some of the copper coins have a thin coating of silver, and one has been gilded.

The Ursuki princes were amongst the few Mahometan dynasties that introduced images on their coins. But they rarely, if ever, engraved their own heads or those of their suzerains on their coins, choosing instead the types of the gold coins either of the Byzantine Emperors or of the Greek Kings of Syria.

The few silver coins of the series weigh about 44 grains, or 2·9 grammes each. The copper coins vary in weight from 43 to 163 grains, or 2·8 to 17·0 grammes.

The Arab systems of money and of weight are treated at great length in Queipo's "Systèmes Métriques et Monétaires des Anciens Peuples." The earlier gold unit was the *dinar*, and the later gold unit the *michtal*. The *dinar* was the monetary unit, from the Roman *denarius*. The *michtal*, which signifies weight, was the unit of monetary weight. Queipo gives a list of 263 gold dinars of the ancient Eastern caliphs which are now in various numismatic cabinets, with their weights. No coins were struck by Mahomet and his successors, who used the existing coinage of the countries, until the 78th year of the Hegira, when both gold and silver coins were struck by Abdelmelik, Caliph of Bagdad. The mean or normal weight of the gold dinar was 66 grains, or 4·25 grammes. This was the weight of the Attic drachma, from which it was evidently derived. There were also gold coins of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{8}$, and $\frac{1}{12}$ *dinar*.

The relation of the weight of the Arab silver *dirhem* to the gold *dinar* was as 7 to 10, or nearly as 2 to 3. Queipo gives a list of 592 Arab silver *dirhem* coins of Arabian caliphs from A.D. 699 to 1195, with the weight of each coin. This varied from about 2·5 grammes in the earlier part of this period up to a maximum weight of 3·1 grammes in later times, the mean weight of the *dirhem* being 2·84 grammes, or 44 grains. He mentions also silver coins of $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ dirhem. The half *dirhem* was thus nearly equivalent to our Saxon penny, the $\frac{1}{240}$th of a pound of silver, and weighing 22½ troy grains.

Queipo makes but little mention of the Arab ancient copper moneys, except to throw a doubt on the existence of the *fels* as a copper coin, and to assume that it was only money of account, and also that the number of *fels* in a dirhem expressed merely the number of units corresponding with the value of copper in relation to silver. He shows that in the first centuries of the Hegira, the value of silver to gold was as 1 to 13, and of copper to silver as 1 to 120. If, therefore, a gold dinar weighed 4·25 grammes, its equivalent in copper would weigh 6,630 grammes; and as the number of *fels* in a *dinar* could not have exceeded 98, that this would give the improbable weight of 67·65 grammes to each copper *fels*. This was the weight of the Attic drachma, from which it was evidently derived. There were also gold coins of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{8}$, and $\frac{1}{12}$ dinar.

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VAN BENEDEN'S "ANIMAL PARASITES"

Animal Parasites and Messmates. By P. J. Van Beneden, Professor at the University of Louvain, &c. (London: Henry S. King and Co., 1876.)

THIS work forms the twentieth volume of the International Scientific Series. We believe there was some doubt on the part of the publishers as to the propriety of bringing out a popular treatise on so uninviting a subject. To have omitted all account of this important series of creatures considered in relation to the welfare of man would, however, have been a serious blunder. It is high time that popular prejudices should be ignored, especially when the welfare of the people themselves is involved in the question at issue. Fully alive to the prejudices referred to, a writer in *Notes and Queries* (who was probably anxious to make the subject palatable) says of this little book: "There is as much amusement to be derived from Prof. Van Beneden's pages as there is instruction." We cannot take this optimist view of the matter; on the contrary, we fail to find anything amusing in the book, although, as might be expected from the author's known position as a man of science, there is much to be learnt from an attentive study of the text. Prof. Van Beneden's strength lies in a clear exposition of the phenomena of commensalism. We owe to his remarkable zoological acumen the correct interpretation of those singular phases of parasitic life which he has so happily classed under the *rôle* of Messmates and Mutualists, respectively. On this head he has strung together such a multitude of facts that his work cannot fail to be useful to working naturalists. Whether the general reader will find anything "amusing" in these pages is very doubtful. He may, indeed, if his mind be still dominated by the teachings of a certain school, find comfort in the assurance which M. Van Beneden affords that the welfare of all the most repulsive forms of insect life is most carefully looked after. What a comfort it must be for the poor Cayenne convict when tortured by insect parasites to know that the ever-helping "Hand" superintends the "preservation" of the larvæ of *Lucilia hominivora* with the same care that it does "the young brood of the most brilliant bird." Surely the Mexican soldier who "had his glottis destroyed, and the sides and the roof of his mouth rendered ragged and torn, as if a cutting punch had been driven into those organs," could hardly be brought to realise the need-be for such a process of development on the score of benevolence towards this frightful parasite! The case of *Lucilia* is by no means exceptional, since there are scores of parasites, both external and internal, that are capable of inflicting the most terrible sufferings alike upon man and beast. Push our author's Bridgwater-treatise-like views to their logical outcome, and it necessarily follows that every pang endured by countless

suffering hosts was expressly designed in order that man might appreciate the benevolence of the "Creator." Such a conception is too horrible to be entertained by reasonable creatures; nevertheless, it is in perfect harmony with certain other grossly anthropomorphic conceptions of Deity that are too commonly taught amongst us.

The general reader will not be able to follow M. Van Beneden very closely, unless he possesses a considerable amount of zoological knowledge; and he will find the book overladen with scientific terms. The naturalist, on the other hand, will be disappointed by the paucity of literary references. Whilst our author shows himself to possess a profound knowledge of the facts of commensalism, his volume is very deficient in the treatment of the subject of parasitism, properly so called, more especially when he deals with those forms that are known as Entozoa. He has omitted all mention of some of the most important helminthological contributions and discoveries of recent times. Thus, there is no allusion to Lewis's "find" respecting nematoid hæmatozoa, and almost nothing is said of the ravages produced amongst domesticated animals by a variety of well-known internal parasites. In some places our author misleads, as in the case of the history of the discovery of *Trichina*, where Sir J. Paget's name is altogether omitted; and also, in the case of *Bothriocephalus*, where Knoch's views on the possibility of infection without the necessity of an intermediary bearer appear to be countenanced.

Some of the illustrations are very poor, and the misspelling of authors' names and of technical words is exceedingly frequent. The author appears to be but little informed respecting the writings of German and English helminthologists. Notwithstanding these defects, M. Van Beneden's book ought to be purchased by every intelligent naturalist. T. S. COBBOLD

OUR BOOK SHELF

The Scholar's Algebra: an Introductory Work on Algebra. By Lewis Hensley, M.A. (Oxford: Clarendon Press; London: Macmillan and Co., 1875.)

THIS is one of the Clarendon Press Series, hence we are saved all necessity of remarking upon the get-up of the volume. We had hardly expected that Mr. Hensley could have imparted any freshness to his treatment of so hackneyed a subject as an Elementary Algebra, but he has done so, and we have read his work with much interest. It does not follow the usual course observed in similar treatises either in its contents or in their arrangement. Our author himself expressly states that the work professes to be an introductory one on algebra. He takes up the scholar who has been well-grounded in arithmetic and endeavours to explain from the outset what algebra is, what its aims, and what the chief forms of its utility. In this attempt he has succeeded, and the work is likely to be of use to students who are reviving an acquaintance with the subject acquired at school, but especially is it suited to self-taught students. For these latter it is, we think, one of the best text-books hitherto brought out. The first seventy pages are devoted to the symbols, signs, and elementary rules; in this section we have a good chapter on Ratio and Proportion, including a glance at incommensurables. Though treated at this length, the scholar is hardly likely to grow weary in his work, and he is laying at the same time a safe and solid foundation for future use.

In Part II. we have Algebraical formulæ (Interest, the Progressions), then Equations (Simple and Quadratic), next Investigation of Methods (Involution and Evolution), closing with a supplement on unknown quantities, Inequalities, Indices (fractional and negative). The third Part opens up to the student under Algebraical formulæ, Permutations, Binomial Theorem, Notation, Harmonic Progression, and simple series, then Equations (more advanced than the previous ones), Surds, Indeterminate Equations and applications of Horner's method. We have then a chapter on Continued Fractions[1] and another on Logarithms. Some idea of the character of the work will be got from the order and nature of the subjects above mentioned, and it will be seen that a prominent feature is the importance attached to methods of calculation. Indeed, Mr. Hensley says he has remarked in the Universities a growing disposition to compel the student of the higher mathematics to interpret his results numerically. To this he gives the weight of his experience: "There can be no better guarantee that he understands what he is about." We may mention that the extension of meaning of the negative sign and of symbols generally, though but slightly glanced at, is yet introduced to the reader's notice. No place is given to properties of numbers, multinomial theorems, convergency of series, higher series, or probabilities. The curriculum is much that laid down by the London University for candidates for the first B.A. (Pass), and we can recommend the book before us as one well suited for such candidates, as containing all they require, and but little beyond what they need take up for the examination.

We shall touch lightly here upon the errata. They are not very serious, and though somewhat numerous, do not by any means come up to the usual standard in this respect of first editions. On p. 98, line 5, for youngest read eldest; p. 127, last three lines, statements should be *vice versâ*; p. 205, line 5 up, read 7×52.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

Fritz Müller on Brazil Kitchen Middens, Habits of Ants, &c.

[MR. CHARLES DARWIN has kindly sent us for publication the following letter, addressed to him by Herr Fritz Müller, the well-known naturalist, brother of our contributor, Dr. Hermann Müller, and who has for so long been devoting himself to natural history researches in Brazil.]

My dear Sir,—In Desterro I met with two young men (M. Charles Wiener, of Paris, and M. Carl Schreiner, from the National Museum of Rio) who, by order of the Brazilian Government, were examining the "Sambaquis" of our province. I accompanied them in some of their excursions. These "Sambaquis," or "Casqueiros," are hillocks of shells accumulated by the former inhabitants of our coast; they exist in great number, and some of them are now to be found at a distance of several miles from the sea-shore, though originally they were, of course, built near the spot where the shells lived. Some are of considerable size; we were told that a Sambaqui on a little island near San Francisco had a height of about 100 metres; but the largest I have seen myself did not exceed 10 or 12 metres. As to the shells of which they are composed, the Sambaquis may be divided into three classes, viz.: (1) Sambaquis, consisting of many different species of bivalve and univalve shells (Venus, Cardium,

[1] We observe that our author says that these were first used by Lord Brounker; it has been shown that Cataldi has a prior claim to this distinction.

Lucina, Arca, Ostrea, Purpura, Tritonium, Trochus, &c.), all of which are at present living in the neighbouring sea. (2) Sambaquis, consisting almost exclusively of a small bivalve shell, the "Birbigãs" of the Brazilians (*Venus flexuosa?*), exceedingly common in shallow bays or salt-water lagoas, the bottom of which is of mixed mud and sand. (3) Sambaquis, consisting exclusively of a species of Corbula, which I have not yet seen in a living state; all the Brazilians also, whom I asked, and who are perfectly acquainted with any edible animal of their marine fauna, are unanimous in affirming that this shell does not live now on our coast. From one of these Corbula-Sambaquis I obtained a specimen of a small Melampus, which I have found living near the mouth of some rivulets, where fresh and salt water are mingling in ever-varying proportions. When the lowlands of the Lower Itajahy and some of its tributaries were as yet beneath the level of the sea, they would have formed a large estuary, and here probably the Corbulæ lived. The fragments of human skulls which we found in one of these Corbula-Sambaquis were of truly astonishing thickness, whereas those I have seen from other Sambaquis are hardly thicker than our own. Among the tools which are to be found in the Sambaquis, stone-axes are by far the most frequent. But as M. Wiener will probably soon publish a full account of his researches, I will now no longer dwell on this subject.

Some time ago I sent to Germany for publication a note on the relation between our Imbauba trees (Cecropia) and the ants which inhabit their hollow stem. As there may be some delay in publishing, I will give you a short abstract. Mr. Belt has already stated that the ants farm scale-insects in the cells of the Imbauba stem, and he believes that their presence must be beneficial. This is no doubt the case; for they protect the young leaves against the leaf-cutting ants (Oecodoma). Now there is a wonderful contrivance by which, as in the case of the "bull's-horn acacia," the attendance of the ants at the right time and place is secured. At the base of each petiole there is a large flat cushion, consisting of most densely-crowded hairs, and within this cushion a large number of small white pear-like or club-shaped bodies (specimens inclosed) are successively developed, which, when ripe, emerge at the surface of the cushion, like asparagus on a bed, and are then greedily gathered by the ants and carried away to the nest. The object of the dense hair-cushion appears to be (1) to secure to the young club-shaped bodies the moisture necesary for their development; and (2) to prevent the ants from gathering the unripe bodies. In most cases it is by honey-secreting glands that the protecting ants are attracted; now Mr Belt observed ("Nicaragua," p. 225) that the honey-glands on the calyx and young leaves of a Passion-flower were less attractive to the ants than were the scale-insects living on the *stems;* this would most likely be the case with the Imbauba, and it is probable that the use of the little pear-shaped bodies is to form an attraction stronger than that of the scale-insects, and thus to secure the attendance of the protective ants on the young leaves. As far as I could make out, the club-shaped bodies consist mainly of an albuminous substance. The ant colonies are founded by fertilised females, which may be found frequently in the cells of young Imbauba plants. Each internode has on the outside, near its upper end, a small pit where the wall of the cell is much thinner than anywhere else, and where the female makes a hole by which she enters. Soon after this the hole is completely shut again by a luxuriant excrescence from its margins, and so it remains until about a dozen workers have developed from the eggs of the female, when the hole is opened anew from within by these workers. It would appear that the female ants, living in cells closed all around, must be protected against any enemy; but notwithstanding a rather large number of them are devoured by the grub of a parasitic wasp belonging to the Chalcididæ; Mr. Westwood has observed that the pupæ of the Chalcididæ exhibit a much nearer approach to the obtected pupæ of the Lepidoptera than is made by any other Hymenoptera" ("Introd. to the Modern Classif. of Insects," Part XI., p. 162). Now the pupa of the parasite of the Imbauba ant is suspended on the wall of the cell by its posterior extremity just like the chrysalis of a butterfly.

I hope you will have received a paper on Æglea, a curious Decapod inhabiting the mountain rivulets of our Serra do Mar. Lately I obtained a large number of specimens of this Æglea, and among them a female with eggs in an advanced state of development. Thus I was enabled to satisfy myself that, like so many fresh-water and terrestrial animals, the marine allies of which undergo a transformation, our Æglea does not experience any metamorphosis. FRITZ MÜLLER

Prof. Tyndall on Germs

YOUR able correspondent "Inquirer" would hardly blame Horatius for taking his enemies one at a time. May I not, then, claim his indulgence for following, in an extremely humble way, the example of the gallant Roman? He may accept my assurance that during the last five months I have found Dr. Bastian quite enough for me.

Moreover, I do not think it likely that Dr. Sanderson and myself will ever cross swords upon this question. Our relation, I am happy to think, will be one of co-operation, not of antagonism. The experiments on pure infusions, not those on mixtures of solids and liquids, to which "Inquirer" directs my attention (NATURE, vol. vii., p. 180), are, in my opinion, too scanty, and too little in harmony with each other, to bear an inference of any weight. To Dr. Sanderson I prefer leaving the repetition of them, with the full confidence that the ability and candour for which he is so distinguished will lead him to a right result.

In repeating these experiments, it would, I think, be well to bear in mind the remarks of Dr. Roberts (NATURE, vol. vii., p. 302), however unimportant they may seem to Dr. Bastian. I would also suggest the substitution, in boiling, of an oil-bath for the Bunsen burner, and, in sealing, the abandonment of the blow-pipe and the use of the simple spirit-lamp flame.

Experiments on milk and pounded cheese are, it may be observed, at present beside the mark. They shall be subjected in due time to the scrutiny already bestowed upon really liquid infusions. It ought not to be forgotten that the jungle we have entered has been growing umbriferously for the last six years, and it is only bit by bit that the sunlight can be let in upon it.

"Inquirer" may count on my sympathetic readiness to minister, however humbly, to the delight he takes in following "every investigation which tends to the development of science." If he cares to see my infusions, it will give me great pleasure to show them to him. Condensed abstracts only of my investigation have been laid before the Royal Society and the Royal Institution; a fuller account of it will follow by and by. Meanwhile, I hope "Inquirer" will accept the assurance that I have been strict—I might say abject—in my adherence to the conditions prescribed by Dr. Bastian in his books. JOHN TYNDALL

Heathfield, Feb. 13

[The following letter has been sent us for publication by Prof. Tyndall.—ED.]

PERMETTEZ-MOI de vous dire combien je suis charmé que vous apportiez dans la question de la génération spontanée la grande autorité de votre esprit philosophique et de votre rigeur expérimentale. C'est tout à la fois un honneur pour mes recherches et une vive satisfaction personelle que les conclusions auxquelles vous êtes arrivé s'accordent si bien avec celles de mes propres travaux, malgré la différence des méthodes que nous avons suivies. Le tour piquant que vous avez su donner à vos expériences les fera pénétrer plus avant que les miennes dans l'esprit de tout lecteur que n'égarent pas les idées *à priori*.

Dans le numéro du 5 février courant du *British Medical Journal* le docteur Bastian accepte sans réserve l'exactitude de toutes les expériences de mon mémoire de 1862 (*Annales de Physique et de Chimie*).

Il accepte également, sans nul doute, les resultats de celles que j'ai publiés en 1863 et en 1872 sur le sang, sur l'urine, sur le jus intérieur des grains de raisin, exposés, dans l'état même où la vie a formé ces liquides complexes, au contact de l'air pur,

privé de ses poussières flottantes. Dès lors je dois appliquer au docteur Bastian ces paroles de mon mémoire de 1862, pages 70 et 71 : "En présence de ces résultats (résultats que je viens de rappeler et qu'accepte le docteur Bastian), un partisan de la génération spontanée veut-il continuer à soutenir ses opinions? Il le peut encore ; mais alors son raisonnement sera forcément celui-ci : 'Il y a dans l'air, dira-t-il, des particules solides, telles que carbonate de chaux, silice, suie, brins de laine, de coton, fécule . . . et à côté, des corpuscules organisés d'une parfaite ressemblance avec les spores des mucidinées ou avec les kystes des infusoires. Eh bien, je préfère placer l'origine des mucidinées et des infusoires dans les premiers de ces corpuscles, ceux qui sont amorphes, plutôt que dans les seconds.'" L'inconséquence d'un pareil raisonnement ressort d'elle-même et le progrès de mes recherches consiste à y avoir acculé les partisans de l'hétérogénie. Lisez attentivement l'article précité du docteur Bastian et vous verrez qu'il se résume en effet, dans le raisonnement que je viens de reproduire. Le docteur Bastian me permettra de placer dans sa bouche ces paroles :—"C'est bien vrai, les expériences de M. Pasteur et celles de M. Tyndall m'ont acculé, moi Docteur Bastian, partisan de la génération spontanée, dans cette déclaration. Oui, je préfère recourir sans motif sérieux, à la croyance à une force résidant dans la partie amorphe des poussières en suspension dans l'air plutôt que de la placer cette force dans la partie organisée formée de corpuscules identiques d'aspect à ceux des germes des organismes des infusions." Parler ainsi n'est-ce pas avouer sa défaite?

Quelles sont donc ces particules amorphes dont vous invoquez si gratuitement l'influence et de quel droit leur attribuez-vous les *primum movens* de la vie? Pourquoi, si vous aviez raison, ne le trouverait-on pas ce *primum movens* dans les particules amorphes ou organisées qui existent à l'etat naturel dans le sang frais, dans l'urine fraîche, dans le jus du raisin, quand on expose ces liquides dans l'air pur? Voulez-vous que vos particules amorphes, douées du *primum movens* de la vie des infusions, sortent de matières déja alterées, putrides, etc. . . . . mais, pourquoi seraient-elles chariées par l'air sans être accompagnées des germes et des êtres vivants de ces infusions et, s'il en est ainsi, comment ne pas placer le *primum movens* de la vie dans ce qui est vivant, plutôt que dans ce qui n'a rien des caractères apparents de la vie?

Elle est inattaquable, cette conclusion que j'ai déja formulée : *dans l'état actuel de la science, l'hypothèse de la génération spontanée est une chimère.* Votre bien dévoué,

Paris le 8 Fevrier, 1876 L. PASTEUR

Mr. Sorby on the Evolution of Hæmoglobin

IN the short notice in NATURE (vol. xiii. p. 257) of my paper on the Evolution of Hæmoglobin, in the *Quarterly Microscopical Journal*, it is said that my conclusions are mainly based on a small difference in the wave-length of the absorption-bands of the spectrum of the red blood of *Planorbis*. This is, however, a very small part of the question. The principal results are that hæmatin is first met with in the bile of many pulmoniferous molluscs in an abnormal state, quite unfit to serve the purposes of respiration, but easily changed into the normal, which could, and probably does in some cases, perform that function. Then in the blood of *Planorbis* we have a *solution* of a hæmoglobin, in which the hæmatin is combined with an albuminous constituent coagulating at the low temperature of 45° C., and finally we come to the normal hæmoglobin existing as *red corpscules*, containing an entirely different albuminous constituent, coagulated at about 65° C. In all these changes in the condition of the same fundamental radical, the oxygen carrier becomes of more and more unstable character, and more fitted for the purposes of respiration, as we advance from lower to higher types, as though advantage had been taken of every improvement due to modified chemical or physical constitution. H. C. SORBY

The Flame of Common Salt

IN answer to a question put by one of your correspondents (p. 287), allow me to state that the origin of the blue flame in question is still involved in mystery. Your correspondent will find everything that is known on the subject in a letter addressed to the editor of the *Philosophical Magazine*, by Prof. J. H. Gladstone (*Phil. Mag.* 1862, vol. xxiv. p. 417).

Prof. Schorlemmer and I are at present engaged in a joint investigation, which we hope will throw some light on the origin of the flame. We have already obtained interesting results, and observed the flame under circumstances in which it has not been seen before, but we are as yet entirely unable to say what the flame is really due to. ARTHUR SCHUSTER

Owens College, Manchester, Feb. 12

Science at Hastings

HAD we here a few more men like Mr. Alex. E. Murray, my paper on "Science at Hastings" would never have been written. But I fail to see in what way he has "vindicated the honour of Hastings." With the exception of one or two sentences which require qualification, his letter is simply an emphatic repetition of what I said in the Hastings and St. Leonards *News*. The substance of my paper may be given in one of its sentences : "With the exception of occasional debates among the members of the Philosophical Society and the few scientific lectures in the winter programme of the Mechanics' Institution, there is in Hastings no public encouragement or aid to science." As to the Philosophical Society, Mr. Murray admits that, "owing to a variety of circumstances, it is not at present quite so flourishing as we could wish." In point of fact, during the session 1874-75, four papers were read and a conversazione held. This Society is the only distinctively scientific one in the town, notwithstanding the "multiplicity" of institutions mentioned by Mr. Murray. Popular scientific lectures are occasionally given in connection with various associations for young men ; and the Mechanics' Institution also has a winter lecture session, but unfortunately the Committee find it very difficult to obtain lecturers, and are fain to eke out their list with musical evenings and readings. The Literary and Scientific Institution has for many years dropped the word "Scientific" from its name, and at present seeks merely to provide for a few of the older inhabitants of the town a quiet reading-room supplied with papers, a few reviews and magazines, and a box from Mudie's. Scarcely a new book has been bought for very many years. The meteorological instruments which the Institution "formerly possessed" were, with the exception of the barometer, broken long ago, and the barometer has since been sold. At one time—twenty years ago—I was in the habit of taking the observations in the absence of the gentleman whose special business it was ; but it must be at least a dozen years since any observations were systematically taken.

In conclusion, I claim to have fully recognised in my paper all that is being done in Hastings in the interests of science, and I sincerely regret that Mr. Murray has not been able to discover any omission on my part. We have no museum, we have no public library in which there are scientific books recent or numerous enough to be of any use to a student, except in a school or two ; we have no Naturalists' or Field Clubs ; with the exception of the Philosophical Society, all the existing institutions in Hastings have practically lost what scientific character they may at one time have possessed ; and the Philosophical Society itself is neither exclusively scientific nor exclusively local in its aims, and is unfortunately "not quite so flourishing" as could be wished. ARTHUR RANSOM

Hastings, Feb. 5

OUR ASTRONOMICAL COLUMN

THE VARIABLE STAR R LEPORIS.—This highly-coloured star, the variability of which was detected by Schmidt in 1855, is calculated to be at a maximum on the 28th of the present month. The mean period appears to be about 438 days, 230 days being occupied in passing from minimum to maximum, and 208 days from maximum to minimum. Probably the irregularities of variation which have been suspected are to be mainly attributed to the difficulty attending comparisons of a star of such intensely red colour. With regard to the colour, however, there is something more than a suspicion that it has sensibly diminished in intensity since attention was first directed to it (Hind, 1845, October). We are almost wholly indebted to Schmidt, who makes such excellent use of the favourable astronomical conditions under which he is placed at Athens, for our knowledge of the law of variation in R Leporis.

SATURN'S RINGS.—In the last (January) number of the "Monthly Notices of the Royal Astronomical Society" are reproduced some old drawings of Saturn, given in the edition of Gassendi's works published at Lyons, in six volumes, in 1658 (Lalande, *Bibliographie Astronomique*, p. 245).

In the volume entitled *De Annulo Saturni*, by E. M. Beima (Augsburg, 1842), a work less known in this country than it deserves to be, will be found other reproductions of the earlier drawings illustrating the appearances which the planet was thought to present in the imperfect telescopes of the time. As a pretty complete monograph up to the date of publication, involving an exposition of the formulæ required in calculating the various phases of the rings, &c., Beima's treatise will be found a very desirable addition to an astronomical library.

THE MINOR PLANET, HILDA (No. 153).—In Herr Kühnert's last orbit of this planet, the aphelion distance is found to be 4·595, and the heliocentric latitude in aphelion, − 6° 33′, the longitude at this point being 105° 1′·6; hence, the least distance of the planet from the orbit of Jupiter is reduced to 0·564 of the earth's mean distance from the sun. So near an approach might afford an excellent opportunity of determining the value of Jupiter's mass, but if the period of revolution assigned by Kühnert upon eight-weeks' observations is at all approximate, such opportunity will not occur for many years to come. There may be a difficulty in recovering this planet at the next opposition, which is likely to take place near the aphelion, and when its faintness, owing to great distance from the earth, will be considerable; it is the more desirable, therefore, that observations should be obtained in the next period of absence of moonlight, that the mean motion may be fairly determined this season; the Ephemeris published in No. 2,075 of the *Astronomische Nachrichten* should render the identification of the planet a matter of no great difficulty in instruments of adequate aperture.

From the *résumé* of observations in No. 42 of the Circulars of the *Berliner Astronomische Jahrbuch*, it appears that No. 149 may get adrift, unless an observation on Nov. 2 can be proved to belong to it, and No. 155, as already remarked, is in even worse position.

THE TOTAL SOLAR ECLIPSE OF 1706, MAY 11–12.—Calculating upon the same system as employed for the solar eclipses to which reference has already been made in this column, the following elements result for the eclipse of May 1706, extensively observed in France, &c.

Conjunction in R.A. 1706, May 11, 21h. 59m. 26s. G.M.T.

R.A.	48° 40′ 27″	
Moon's hourly motion in R.A.	36 49	
Sun's " " "	2 50	
Moon's declination	18 42 52	N.
Sun's "	18 4 0	N.
Moon's hourly motion in decl.	13 9	N.
Sun's " " "	0 36	N.
Moon's horizontal parallax	60 35	
Sun's " "	9	
Moon's true semi-diameter	16 31	
Sun's " "	15 49	

The following are points upon the central track of the shadow:—

Long.	Lat.		Long.	Lat.
5° 40′ W.	34° 39′ N.	...	16° 32′ E.	52° 23′ N.
1 4 E.	40 40	...	20 2 E.	54 20 N.
4 18	43 29	...	Central at Apparent Noon in Long. 29° 7′ E. Lat. 58° 18′ N.	
7 37	46 12 N.	...		

For examining the circumstances of the eclipse in the South of France, where the totality was witnessed, we have the following reduction equations founded upon a direct calculation for Avignon:—

Cos. $w = 41{\cdot}1909 - [1{\cdot}72518] \sin. l + [1{\cdot}59372] \cos. l, \cos. (L - 103° 46'{\cdot}3)$
$t =$ 21h. 26m. 5ˢ·8. $\mp [2{\cdot}08389] \sin. w + [3{\cdot}60351] \sin. l$
$- [3{\cdot}84024] \cos. l, \cos. (L + 38° 1'{\cdot}4)$.

In these equations L is the longitude from Greenwich reckoned *positive* to the *eastward*, l the geocentric latitude, and t the *Greenwich* mean time of beginning or ending of totality, according as the upper or lower sign is used.

PROF. FLOWER'S HUNTERIAN LECTURES ON THE RELATION OF EXTINCT TO EXISTING MAMMALIA[1]

I.

IF no certain *consensus* has yet been arrived at as to what palæontology teaches in reference to the derivative hypothesis, the chief reason is our very imperfect knowledge of palæontology, arising partly from the necessary imperfection of the geological record caused by the very small chance of the remains of any creature living upon the earth being preserved in a perfect state; partly from the very minute portion of the record which is actually preserved in the rocks having as yet been rendered accessible to investigation; partly from the defective knowledge of the structure and relationship of those documents, so to speak, which have already been brought to light, and of their existing representatives. The first cause must always remain a stumbling-block to these investigations. The second is gradually being removed by fresh explorations in many parts of the world, notably those now carried on with so much energy and success in North America. The third is one which only needs more numerous and more earnest workers to remove, and especially those who have the power and will to see the continuity of the manifestation of life upon the earth, and will abandon the old practice of studying the fauna of a particular epoch apart from that which preceded or succeeded it, and especially that of studying extinct forms without a thorough mastery of the key to the solution of the difficulties of their structure afforded by the more accessible existing species. Palæontology is no science apart—it can scarcely even be called a branch of zoology; it is simply the application of that science to elucidating the structure of beings now extinct. The thoroughly unscientific and mischievous system of arrangement of nearly all our great public museums, both at home and abroad, where two distinct collections are kept up, under distinct custodians—one for animals existing at the present moment upon the earth, and the other for animals that have existed at all other periods put together—has much to answer for in impeding the progress of sound zoological knowledge. Granted that our information is of a very limited nature, it still seems worth while occasionally to gather together the fragments of which it consists; and as it would be impossible in the time allotted to this course to do justice to more than a limited portion of the whole animal kingdom, it is proposed to take the class of mammals, as in many ways well suited for testing whether such facts as are known of their ancient history throw any light upon their mode of origin, and to point out, with impartiality, the results of the investigation. The poverty of the materials in some quarters, as well as their abundance in others, will thus be made manifest, and some useful landmarks afforded which may direct and stimulate future research.

As far as we know of the existing fauna of the world, and we can hardly suppose that in this respect our knowledge is not final, the Mammalia constitute a clearly defined group or class of the Vertebrata. Though covering a wide range of variety in structure, scarcely any zoologist has ever had any hesitation in defining its limits. There are, however, certain forms decidedly aberrant, and which in many of the characters in which they deviate from the ordinary standard of the class, approximate to the lower groups of vertebrates. The most marked examples of

[1] Abstract of a course of lectures delivered at the Royal College of Surgeons "On the Relation of Extinct to Existing Mammalia, with Special Reference to the Derivative Hypothesis," in conclusion of the course of 1873. (See Reports in NATURE for that year.)

this condition are seen in the Marsupials, and in a still higher degree in the small order of Monotremes. These present a marked approach to the *Sauropsida*, or reptile and bird group. Such semi-transitional forms, as they may be called, furnish valuable indications of the route by which the higher types might have been brought about, and appear, upon the evolutionary hypothesis, to be unmodified survivors of a condition which was only transitory in the large bulk of the class. Their value as evidence for gradual development would be greatly strengthened if corroborated by palæontology. Beyond them nothing is known in the present condition of life of any truly intermediate forms between the Mammalia and the other class of vertebrates, and the same must be said, as far as we know at present, of all former ages. The line which we now draw round the class to separate it from all others will include within its limits all hitherto discovered mammalian remains. No forms more transitional, or approaching nearer to any other class, or even, as we shall see, so near as do the Monotremes, occur in the records of palæontology. Of course our evidence on the subject is only negative, and as such has little real value. The first appearance, of which we are at present informed, of mammals upon the earth, was early in the Mesozoic period, in the epoch called Triassic. At that time the other classes of Vertebrata, except, perhaps, birds (but our evidence here is defective), had long been well established and distinctly defined. Indications of mammalian life occur in various formations, at different ages, and at scattered points upon the earth's surface, throughout the Mesozoic ages, but during its later stages are entirely lost. These indications, though very fragmentary, all show animals of minute proportions, and for the class to which they belong, rather low organisation. With the commencement of the Tertiary period, however, a total change takes place. Wherever the great Cretaceous ocean bottoms have been elevated so as to become the fit habitation of terrestrial animals, there mammals of varied size, form, and function have been found to dwell, and have left their remains, and from henceforth to the present time there is abundance of evidence of their continuous occupation of the earth's surface. The total absence of all marine mammals in the Cretaceous epoch, the fauna of which is, on the whole, so well preserved, and the absence of land mammals in the Wealden, are facts, which though difficult to account for, must not be overlooked.

Before proceeding to the consideration of the history of the special groups of Mammalia, attention may be called to a few points of general interest relating to the whole class, in which palæontological researches appear to have shown some evidence of gradual modification or progression as time advanced. The first is a small point, as it relates only to one family of animals, but it affords a good illustration of the parallelism which has been observed between the development of the race and that of the individual. The earliest known forms of deer, those of the Lower Miocene, as remarked by Gaudry, have no antlers, as the young of the existing species. The deer of the Middle Miocene have simple antlers, with not more than two branches, as in existing deer in the second year. In the Upper Miocene, species occur with three branches to the antlers, but it is not until the Upper Pliocene and Pleistocene times, that deer occur with antlers developed with that luxuriance of growth and beauty of form, characteristic of some of the existing species in the perfectly adult state. Next, the teeth in the greater number of Eocene mammals, both herbivorous and carnivorous, were of a much more generalised character than at present, and, as shown by Owen, commonly presented the full typical number of three incisors, one canine, four pre-molars, and three molars in each side of each jaw, making forty-four in all, a number found only in two genera at present existing. These teeth, moreover, in many species were more uniform in character and regularly placed, without intervals, in the jaws than in most of the later forms. They were also usually very short-crowned, and many cases can be traced of a successive lengthening of the crowns of the molars, and consequent greater provision for the wear of the organ, in a closely allied series of animals passing through successive geological epochs. Lastly, as remarked first by Lartet, and subsequently by Marsh, there has been in many groups a gradual increase of the size of the brain, as ascertained by the capacity of the interior of the cranium. Most of the Eocene mammals had very small brains in proportion to their size; this is well exemplified in the earliest known European Eocene carnivorous mammal, *Arctocyon primævus*, and still more strikingly in the huge American *Dinocerata*, animals nearly as large as the existing elephants, but whose brain cavity more resembles that of a reptile, being not more than one-eighth the capacity of that of a rhinoceros. The Miocene mammals of the same country had better developed brains, but even in the Pliocene Mastodons they did not equal the existing Proboscidea. A similar progression of brain capacity has been observed among deer, among the tapiroid Ungulates, and in a very well marked manner among equine mammals, especially from the Eocene *Orohippus*, through *Miohippus* and *Anchitherium* of the Miocene, *Pliohippus* and *Hipparion* of the Pliocene, to the recent *Equus*.

(*To be continued.*)

MADAGASCAR[1]

As most probably many of our readers know, a wealthy Parisian, M. Alfred Grandidier, who is thoroughly acquainted with Madagascar in all its aspects, has undertaken a mighty work on the physical, natural, and political history of the island, which is to form, when completed, twenty-eight volumes in large quarto, profusely illustrated with coloured plates. Six volumes, three of text and three of plates, are to be devoted to the Mammals, the first of each of these being those under notice on the present occasion. They, together with the Birds, in three volumes, and the Crustacea, are under the editorship of M. Alph. Milne-Edwards. The Fishes are undertaken by Dr. Sauvage; the Reptiles by M. Grandidier; the Insects by MM. Kunckel d'Herculais, Lucas, Oustalet, De Saussure; the Annelids by M. L. Vaillant, and the Mollusca by MM. Fisher and Crosse.

In the volumes before us there are 122 plates devoted to the anatomy of the Lemurian family *Indrisinæ*. *Propithecus diadema*, *P. edwardsii*, *P. verreauxii*, *P. deckenii*, *P. coquerelii*, *P. coronatus*, *Avahis* (*Microrhynchus*) *laniger*, *Indris brevicaudatus* are the species figured. Of these plates, thirty-nine refer to their osteology, more than twenty to their myology, forty to their visceral anatomy, thirteen to their external form, and twelve (as photographs) to the configuration of the feet. Most of these plates are exquisitely coloured, and all are beautifully drawn; the livers being the only organs with which we have any fault to find. The volume of letterpress only extends as far as the myology, the account of the viscera not having yet appeared. It is to do so in March next. From the drawings alone many particularly instructive facts may be learnt. The colic caecum of *Propithecus* is seen to be comparatively short and capacious, at the same time that the helix formed by the convolutions of the colon itself is as considerable as in any ruminant animal. In *Avahis* the helix is much less developed, whilst the caecum is longer. In *Indris* the caecum is enormously long, not being wide, the colic coil not forming a helix, but being disposed in parallel

[1] "Histoire Physique, Naturelle et Politique de Madagascar." Publiée par Alfred Grandidier. "Histoire Naturelle des Mammifères." Par MM. Alph. Milne-Edwards et A. Grandidier. Vol. VI. (texte) et Vol. IX. (atlas). (Paris: Imprimerie Nationale, 1875.)

transverse rows. The liver of *Avahis* is represented without any gall-bladder (it may be embedded), this viscus being large, and having, as in the typical lemurs, its fundus reversed from its ordinary position, and buried in the hepatic issue in the two other genera. The caudate lobe of the liver is absent, and the spigelian is of fair size. These points, it may be mentioned, have been previously recorded by Prof. Flower in his Hunterian Lectures before the College of Surgeons in 1872, on the visceral anatomy of the Mammalia. In *Propithecus* the left subclavian artery is shown to be given off from the innominate trunk, whence spring the three other main anterior vessels, whilst in *Avahis* and *Indris* it springs independently from the aorta. As in the other Lemurs and the Swine, the mesenteric arteries run straight to the walls of the viscera they supply, and do not form loops just before they reach them; they anastomose freely at their origins.

M. Milne-Edwards gives as the dental formulæ of the Indrisinæ the following:—

Milk dentition . . . $i\ \frac{2}{2}\ c\ \frac{1}{1}\ m\ \frac{2}{3} = 22$

Permanent dentition . $i\ \frac{2}{2}\ c\ \frac{1}{0}\ p\,m\ \frac{2}{2}\ m\ \frac{3}{3} = 30$

Whether or not this method of expressing the dentition is correct is a matter of uncertainty, it depending on the nature of the outer lower cutting teeth of the typical Lemurs. We cannot, with many zoologists, help retaining the opinion that the outer lower incisor-like teeth of *Lemur* and its nearest allies are canines, and they most certainly represent the outer pair in *Indris*, in which they are larger than the inner. The presence of a third lower milk molar confirms the opinion expressed by Prof. Huxley[1] in his memoir on the Angwántibo (*Arctocebus calabarensis*), that in the adult Indrisinæ it is a premolar which is missing in each semi-jaw.

M. Milne-Edwards gives elaborate measurements of the bones of the three genera, which are also represented in the graphic form, on ordinates, by which means excellent comparisons can be made at a glance.

In the myological section of the work, the contributions by Vrolik on *Stenops*, Messrs. Mivart and Murie on *Nycticebus* and the Lemuroidea generally, Van Campen and Van der Hoeven on the Potto, Burmeister on *Tarsius*, and Prof. Owen on the Aye-Aye are employed for comparison, and the whole monograph has filled the only important gap, till now vacant, in our knowledge of the anatomy of the Lemurs.

SCIENCE AND ART IN IRELAND

AN important announcement as to the proposed action of the Government with regard to the various scientific institutions in Dublin is contained in the following article, which we reprint from the *Times* of Tuesday last:—

The subject of the administration of Science and Art in Ireland in connection with increased State aid has now been under discussion at different times for many years. It must not be imagined, however, that Ireland is not already provided with numerous institutions for the promotion of Science and Art, or that it lacks grants for that purpose. In Dublin alone there are under the management of the Royal Dublin Society, which is a chartered body, a Museum of Natural History, Botanic Gardens (with Botanical Museum), and a library. Next comes a purely national institution, the Royal College of Science, with its small industrial collections and the geological collections of the Geological Survey. On the borderland of Science and Art we have the Royal Irish Academy, with its library and Antiquarian Museum, containing the richest collection of Celtic antiquities existing out of Copenhagen, including the celebrated Tara Brooch and Tara "torques," and the Cross of Cong.

[1] Proc. Zool. Soc., 1864, p. 327.

Coming to the region of Art pure, we have the School of Art, under the management of the Royal Dublin Society; the Royal Hibernian Academy, corresponding to our own Royal Academy (which also has its School of Art); and lastly, the Irish National Gallery. So far as we can gather from the estimates, the total grant to Science and Art Institutions in Dublin is upwards of 25,000*l.* a year, though it is difficult to obtain very precise information on this head, as the votes are taken, some by the Science and Art Department, some by the Treasury, and some by the Office of Works.

The Library, the Natural History Museum, and the Botanic Gardens have since 1865 been entirely supported by the State, though managed by the Dublin Society acting as trustees, while the collections of the Royal Irish Academy, which receive an annual subsidy of about 2,000*l.* besides a house, have been very largely purchased out of public funds. The Royal Dublin Society has of late years devoted its energies and its private funds most usefully in furtherance of agriculture. The Royal Irish Academy not only covers the field of the Royal Society of England, but also takes under its care literature and antiquities.

It will thus be seen, to compare the State supported institutions in Dublin with those in London, that the elements of the British Museum, the Geological Museum, the South Kensington Museum, the National Gallery, and Royal Academy exist in Dublin, to say nothing of the Royal College of Science, which has a more complete course than our own School of Mines. In spite, however, of the number of these institutions, and, in fact, because of their number, the collections, whether of books, natural history specimens, or antiquities, have not had the completeness which one would expect. While on the one hand many have been inconveniently housed, on the other the Government has naturally felt a difficulty in improving their condition so long as they were in the hands of more or less irresponsible private bodies, and hence the many attempts to bring about a consolidation, to which we may briefly refer.

Thus we find that in 1862 the Treasury appointed a small Commission, with Sir C. Trevelyan as chairman, which made certain recommendations. Before these were acted on, however, the subject was, in 1864, taken up by a Committee of the House of Commons, of which Mr. Gregory was chairman. This body dissented widely from the views expressed by the Treasury Commission, and thus the matter rested till 1868, when the Government decided to constitute a separate Department of Science and Art for Ireland, "analogous in its constitution to the existing Science and Art Department in London for the United Kingdom;" and appointed a Committee, of which the Duke of Leinster, then Marquis of Kildare, was chairman, to report on the best means of carrying out the project.

The Committee, having upon it such representative Irish members as the Marquis of Kildare, the Very Rev. Dr. Russell, the then President of Maynooth, the Rev. S. Haughton, and Mr. G. A. Hamilton, the then Secretary of the Treasury, soon found it impracticable to organise such an independent department as had been contemplated, and applied for an enlargement of their instructions; in fact, it became evident very early in the inquiry that all but a small minority in Ireland were in favour of continuing the connection with the English Department. Teachers and students specially petitioned that the connection might be maintained, as they saw clearly that the severance would deprive them of the highest rewards and best promises of a career by cutting off the English field from them. However much some may regret the fact, the fact remains that in all vocations the highest talent will seek the place where it is most highly prized and rewarded, which in the case of the United Kingdom means London.

Acting upon this and other considerations, to which we need not further allude, the Commission unanimously came to the conclusion that the remedy they were seeking lay, not in the formation of a separate Department for Ireland—which, indeed, they went on to say would be detrimental to the interests of Science and Art in that country—but in the consolidation and better administration of the existing institutions, and in the filling up of some obvious gaps. The essence of their recommendations was the amalgamation of several of the collections into an institution strongly resembling the South Kensington Museum, but covering a wider field, which should be administered by a director, who should be in immediate relation not only with the Minister of Education, but also with the Irish Government. This scheme, however, had a great drawback in the eyes of many of the leading noblemen and gentlemen in Ireland who were interested in the existing institutions, because it entailed the deprivation in the case of the two principal societies —the Royal Dublin Society and the Royal Irish Academy —of the privileges they had hitherto enjoyed of administering large public funds voted for the Natural History Museum and the Botanic Gardens, as well as other institutions. This objection and, possibly, the economical views of the late Government, have sufficed to keep this question in abeyance since 1868; but it now appears that the present Government have determined to take some decided step, for they have, we understand, during the last few days communicated with the bodies principally interested in the scheme.

From the information which has reached us we gather that the plan now proposed is as complete as that indicated by the Commission of 1868, although it is not identical with it. Thus it has been decided to build a Science and Art Museum for Ireland similar to that now existing in Edinburgh. This will occupy a site adjacent to the principal buildings which now exist, and will consist of collections analogous to those of the South Kensington Museum, to which will be added the antiquarian collection of the Royal Irish Academy, and the industrial collection of the old Museum of Irish Industry. The building will also provide space for the Natural History Museum and Geological Collection, and will thus set free the present Natural History Museum, to which the library of the Royal Dublin Society will be transferred and formed into a public National Library.

As may be imagined, this comprehensive scheme will entail the expenditure of a large amount of public money, and the Government make the offer contingent on the surrender of the privileges to which we have before referred, and the vesting of all the property in the Government. With the view, however, of still enabling those who at present take so great an interest in the existing institutions to continue this useful co-operation and represent the special wants of the country, it is proposed that the new National Library shall be managed by a Council of twelve trustees—eight to be nominated by the Royal Dublin Society and four by the Government; while the administration of the Science and Art Museum, which is to be under a director appointed by the Crown, as in Scotland, will be controlled by a Board of twelve visitors—four nominated by the Lord Lieutenant; five by the Royal Dublin Society; and three by the Royal Irish Academy.

It is not proposed to interfere with the functions of the societies we have named, and we are glad to see that the Government propose still to continue the aid they now give to them.

In making these proposals the Government has taken the opportunity of putting on record its appreciation of the eminent services which have been rendered to both art and science by the societies we have named, and makes it clear that the motive for suggesting any diminution of their independence is, that the wants of the community with regard to such matters as public museums have now in Ireland, as long ago in England, outgrown the useful operation of private societies.

The surrender of what we may, we hope, without offence, term some of their ornamental functions, will no doubt be somewhat painful to their members; but we cannot suppose that they will allow their private feeling to stand in the way of a national scheme so rich in promise, and based on principles which we should be glad to see applied in other localities besides Dublin.

MINIATURE PHYSICAL GEOGRAPHY

THE sands of the Lower Bagshot series are exposed along the shore at Bournemouth and form the cliffs. They are agglutinated into a very friable sandstone, which

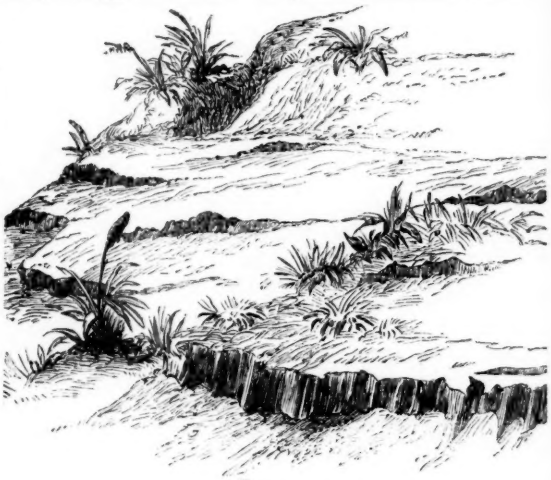

FIG. 1.

disintegrates under the influence of rain with extreme readiness. The siliceous grains are cemented together, probably by carbonate of lime. At any rate the adhesion of particle to particle is very slight and easily relaxed.

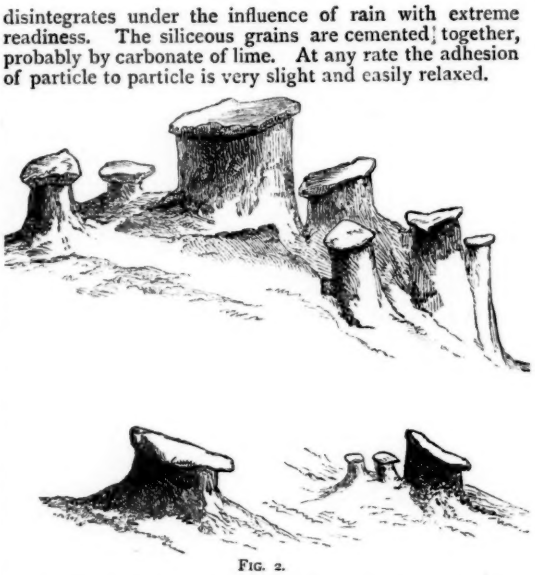

FIG. 2.

The result is that phenomena of erosion which elsewhere take years, centuries, ages, display themselves here on a miniature scale, and in a very short space of time. All the details of a river drainage system may be seen

with perfect completeness in the space of a few square yards. Watersheds bounding contiguous basins, gently sloping plains, deeper valleys, steeply cut ravines may be recognised according as the rock varies here and there in more or less of cohesiveness.

The slight inequalities in this respect give rise to many other details worth noticing. On the vertical surface of the cliffs the rock is etched in a manner scarcely perceptible unless the sun shines obliquely on its surface. In this way a rock apparently homogeneous is seen to have been originally built up of layers deposited at the most various angles in the manner characteristic of what is called false bedding.

Here and there an undisturbed talus at the foot of a cliff has been permeated by water carrying some cementing material which feebly binds together again the incoherent sand. The base gets washed or blown away, and the surface of the talus is seamed with miniature landslips leaving steep and precipitous cliffs of the frightful height of at least two to three inches. These precipices are scored and columned with the sharpest fluting as they have been planed down by the subsiding soil (Fig. 1 reduced).

Here and there again the rock is traversed horizontally by layers, in which the cementing material is ferruginous. When the rock is denuded down to this it first gets washed pretty bare and then broken up into angular fragments by the frost. Each of these fragments protects the rock beneath, and so gradually gets mounted upon a little pedestal like the perched blocks of a Swiss glacier or the mud columns in the valley of Visp (Fig. 2, natural size).

T. D.

PHYSICAL SCIENCE IN SCHOOLS

THE struggle which Physical Science has had to obtain a footing amongst the regular subjects of the school curriculum has not been altogether in vain, and the study of science now occupies a conspicuous place in the prospectus, at any rate, of many of our schools. But to those who, being behind the scenes, are acquainted with the real facts, the position which science occupies amongst other subjects, with a few honourable exceptions, is insignificant in the extreme. It is admitted as an axiom by all science teachers, that if the study of science is to be of any value, the student must, in some part at least of his work, be brought face to face with the facts of nature, and that unless this be the case the introduction of the subject into the school course is worse than useless; but how commonly does the so-called science-work of a school consist simply in the acquisition of so much "useful knowledge?" And even when in other respects the teaching is fairly satisfactory, the practical work is too often optional—an "extra," or taken on half-holidays, and so ruined by the competition of cricket and football.

We believe that a fair standard by which to judge of the present position of the study of science in schools is to be found in the "Regulations of the Oxford and Cambridge Schools Examination Board," and in the papers set at the examination for certificates (the first held) of July 1874. Certificates are awarded to those who succeed in passing in a certain number of subjects; and the possession of such a certificate should indicate that a boy has obtained a thorough education up to the point fairly to be expected on leaving school.

Regulation 7 provides that "the examination for certificates shall include the following subjects:—

"GROUP I.—(1) Latin; (2) Greek; (3) French and German.

"GROUP II.—(1) Mathematics (Elementary); (2) Mathematics (Additional).

"GROUP III.—(1) Scripture Knowledge; (2) English; (3) History.

"GROUP IV.—(1) Natural Philosophy; (2) Heat and Chemistry; (3) Botany; (4) Physical Geography and Elementary Geology.

Every candidate shall be required to satisfy the examiners in at least four subjects, taken from not less than three different groups."

From the foregoing Regulation, one would naturally suppose that equal value was attached to each of these subjects, an arrangement which would leave no room for the complaint that science did not receive its proper credit. Let us examine whether such is the case.

The examination papers show that out of more than fifty-two papers set, *only four* were set on scientific subjects. To pass in Latin it would seem that *five* different papers must be satisfactorily answered, in Greek *four*, in French and German *eight*, in Elementary Mathematics *three*, in Additional Mathematics *four*, in Scripture Knowledge *three*, in English *three*, in History *one*, in Natural Philosophy *one*, in Heat and Chemistry *one*, in Physical Geography *one*, in Botany *one*. We may not unfairly take these numbers as representing the relative value of the different subjects in the eyes of the compilers of the Regulations.

Thus, while a candidate who, having received his training in languages, selects, say Latin, French and German, English, and Elementary Mathematics, has to answer nineteen papers—the same certificate may be cheaply obtained from *seven* papers, by selecting Scripture Knowledge, Elementary Mathematics, Chemistry, and Physical Geography.

Next let us examine the kind of questions set. Elementary Mathematics means simply Arithmetic, Euclid, books i. and ii., and Algebra to simple equations. In Heat and Chemistry we find the following, amongst others (space does not permit to transcribe the whole paper).

1. Define "co-efficient of expansion." What relations subsist between the linear, superficial, and cubical expansion of a piece of iron?

2. Describe fully the successive changes which occur when a piece of ice is placed in an open vessel, and the vessel then gradually heated to, say, 150° C.

3. What are our available sources of heat?

4. What degrees on the Centigrade scale correspond to 16° R. and − 4° F.? At what temperature will Fahrenheit and Centigrade thermometers give the same reading?

5. Distinguish between elements and compounds, and between compounds and mixtures.

6. What is the composition of the atmosphere? Give the outlines of a method for analysing it accurately. How is it proved to be a mixture and not a chemical compound?

7. I want to convert 132·4 grm. of lead nitrate into lead sulphate. How much potassium sulphate will effect this change, and how much lead sulphate shall I obtain? (Pb = 207, K = 39.)

In Physical Geography:—

1. How may the earth be proved to be a globe, and in what respects does it differ in form from a perfect sphere?

2. Show by examples how climate is affected by the position of a locality independently of the latitude?

3. Define the terms *watershed*, *denudation*. Give instances of denudation effected by rivers.

4. Explain the terms *dip*, *strike*, *joints*, and *faults*.

5. What is supposed to be the origin of coal, and on what facts is this supposition based?

6. Name and describe fully the accompanying specimens:—

[Specimens: Granite, oolite, dolomite, selenite, and two bivalve fossils.]

It is to be remarked that, with the exception of the last question, there is no test of a practical kind at all. Is the knowledge of the composition of the air, of the reasons for believing that the earth is round, of the meaning of the terms *watershed*, *dip*, &c.—is this the utmost that should be demanded of a boy of eighteen who has studied science instead of the older well-established subjects of classics and mathematics?

Compare with this the extent of knowledge expected in other subjects. French and German, for example, together form one subject: to succeed, the candidate must be proficient in dictation in each language; translation from unseen authors; the grammar, history, and etymology of the languages; translation from English into French and German, besides translation from books appointed. For the last examination, books which might be chosen were—in French, Pascal's "Provincial Letters;" in German, Goethe's "Faust" *and* "Italiänische Reise."

The relative value attached to different branches of science is also worthy of remark. Chemistry, for example, is supposed to be so far inferior to Botany as an educational study, that the slight subject of *Heat* is added as a make-weight.

It is really hard to determine whether the compilers of these Regulations (the head-masters of one or two of our most important schools being amongst them, if report errs not) have acted simply in ignorance of what physical science in a school ought to be, or whether this is an ingenious device to strangle science as a school study, and to get rid of the obnoxious interloper by driving the weak and idle to it, and thus giving it a bad name as "the refuge of fools."

N. MARSHALL WATTS

PROF. MAX MÜLLER

IT was decided at a Convocation held at Oxford on Tuesday that an inducement should be offered to Prof. Max Müller to continue to honour Oxford by remaining connected with that University. It would certainly have been a disgrace had no effort been made to retain the services of so eminent a scholar, which other countries are eagerly anxious to obtain. The proposal made by the Dean of Christ Church, which was carried by a large majority, was to relieve Prof. Müller of the obligation to lecture, and to provide for the appointment of a deputy, who should receive one-half of the salary of the present Professor. This scheme is confessedly somewhat of a makeshift; time was of importance, and the proper course, by statute, because lengthy, was not available. Vienna had offered the Professor a Chair of Sanskrit and provision for the publication of his books; and to this offer an immediate answer was necessary. The present, the Dean wished it to be understood, was a provisional arrangement in view of impending changes. The Dean was authorised to state that the Government "Universities" Bill would constitute an Executive Commission, with powers to receive schemes from Colleges, and to base upon them the new University and Collegiate organisation. He pledged himself there should be an opportunity given for considering in constitutional form the permanent arrangement of the matter at present in hand. He defended the decree from the charge of robbing Comparative Philology, for Sanskrit studies were an essential part of it, and the arrangement would give an admirable opportunity for some young man to make out his claim to the Professorship. He could have wished the arrangement had been more liberal, but, in fact, the University had come to the end of its tether. The Dean then dwelt on the high value of the Professor's services. He told how Mr. Max Müller had "audaciously" projected, when but a youth and a pupil of Burnouf, an edition of the Rigveda. For this he was forced to come to England, for which purpose he raised funds by translations, &c. Bunsen, on whom he called without introduction, had forwarded him to Prof. Wilson, and the India House, with sagacious liberality, took him up. Dean Gaisford had bidden men read Homer, with some ancient commentator, as the key to Greek literature. If these had been only accessible in manuscript, involving the reading, indexing, and perpetual annotation of infinite other MSS., who would have undertaken the task? And this was what Max Müller had done. Dean Liddell knew not whether to admire and wonder at most—his ardour in commencing, his perseverance in continuing, or his genius in the execution of his work. With regard to a recent statement as to Prof. Müller's future work, the Dean stated the fact to be that the University had accepted the offer of publishing a choice selection of translations from Sacred Books—at the utmost, twenty-four volumes. But this, it was obvious, was sufficient to prevent the Professor from enjoying the position of a sinecurist. The Dean concluded by enumerating a list of the Professor's distinctions, and urged the University to keep him if it could, how it could, while it could.

We must say that most of those who spoke in the discussion which followed missed the real point at issue. Prof. Max Müller has already rendered such important services to Oxford, to England, and to Science, and proved himself so competent to continue these services, that there should have been no hesitation whatever about endowing him sufficiently to enable him to continue his valuable researches unhampered. But we must be thankful for small mercies at present, hoping from the hint dropped by the Dean that better things are in store.

PROF. NORDENSKJÖLD ON THE JENISEI[1]

I HAVE before mentioned the great abundance of extraordinarily delicate varieties of fish which Jenisei yields, and that during our river journey we made as complete a collection of them as possible. The steamer's tedious voyage was, besides, employed by me in collecting statements regarding the names of the most important varieties, the price paid for them on the steamer, and their size.

	Common weight.	Greatest weight.	Price.
Njelma[2] ...	13 lb. ...	50 lb. ...	80 kop. per pood.
Tschir ...	6 „ ...	25 „ ...	10 „ each.
Omul ...	1½ „ ...	3 „ ...	2 „ „
Muksum ...	4 „ ...	12 „ ...	9 „ „
Salmon ...	16 „ ...	80 „ ...	—
Sterlet ...	3 „ ...	30 „ } ...	150 kop. per pood.
Sturgeon ...	16 „ ...	280 „ }	
Silj ...	— ...	— ...	40 „ „

The trade, however, is carried on here in this way, that the goods to be purchased are valued in coin, but payment is made in goods at the merchant's valuation, on which account the true price is perhaps considerably below that which is here stated.

After the numerous crew on the *Alexander* and the "lodjors" had attended with great devoutness a festival service in the church of the monastery and a neighbouring chapel where the holy founder's dust and work-harness are preserved, after we had seen several of the remarkable things belonging to the monastery, and among them an exceedingly well-preserved Sclavonic Bible from the sixteenth century, and after I had paid a visit, along with the captain, to an aged cripple who in his youth had made a pilgrimage to Jerusalem, we steamed on. Our progress, as was commonly the case, was slow, in consequence of the strong current and the frequent stoppages, which of course we turned to account by making excursions to examine the natural history of the region, by conversing with the inhabitants, &c. The latter consist partly of Russians who have settled there, partly of natives, "Asiatics," who frequent the rivers during summer, partly on their own account, partly as employed by Russians. In such circumstances their dwellings consist of tents of quite the same form as the Lapp "kota." The Samoyede tent is commonly covered with reindeer skins, the Ostiak tent with birch bark. A number of dogs are always found in the neighbourhood of the tent, which during winter are used for general draught purposes, and in summer for towing up boats against the current—a means of transport on water which greatly surprised our seal-fishers. For this purpose a sufficient number of dogs are harnessed to a long line, one end of which is fastened to the stem of the boat. The dogs then go forward upon the level bank, where in this way

[1] Continued from p. 277.

[2] Njelma, Tschir, Omul, and Muksum are varieties of the Gwyniad. Silj is the fry, or young, of the same fish.

true dog-tracks are formed, and the boat, which requires only a moderate depth of water, is kept afloat at a sufficient distance from the bank by the rudder, which is managed by a person sitting in the stern of the boat. The boats are often hollowed out of a single tree stem, and may be notwithstanding, thanks to the dimensions the trees attain in these regions, of very beautiful form and very large. The dogs have a strong resemblance to the Eskimo dogs in Greenland, which are also employed as draught animals, which may perhaps be considered a proof that the same climatic circumstances and a similar method of employing a species of animals create like races. Most of the natives who come into intimate contact with the Russians at the present time, we are informed, profess Christianity. That many heathen customs still, however, cleave to them is shown by the following incident. At a "simovie" where we landed for some hours on Sept. 16, we as usual came upon a burying-place in the wood near the dwelling-houses. The corpses were laid in large coffins above ground, with a cross in nearly every case raised over them. At one of the graves there was a consecrated picture fixed to the cross, which must be considered an additional proof that a Christian reposed in the coffin. Notwithstanding this, several garments, which had belonged to the deceased, were found hanging on a bush near the grave, together with a bundle containing food, principally dried fish. At the graves of the richer natives we are informed that the survivors place, together with food, some rouble notes, in order that the departed may not be altogether destitute of ready money on his entrance into the other world. But that fine clothes are not considered any special recommendation with St. Peter was evidenced by the exceedingly shabby, tattered, and patched condition of the garments hung up at the grave in question.

Hitherto we had during our journey from Dudino up the Jenisei for the most part very fine, often warm, autumn weather. The first frost occurred south of Saostrovskoi on the night before Sept. 20, and from that date the temperature of the nights was generally under the freezing point. The days, however, continued to be warm and fine. The fall of rain was slight.

On the 20th we anchored at the mouth of one of the largest tributaries which fall into Jenisei from the east, viz., Podkammennaja Tunguska. Immediately below a welcome opportunity offered of taking soundings right across the river, which is here over a kilometre broad. A little distance from the western bank the lead showed four fathoms, afterwards the depth again diminished to 2½ fathoms, but afterwards increased anew to seven fathoms. At a number of other places also soundings were taken, which are believed to confirm the statement of the pilots that the depth of the river as far up as Jeniseisk is sufficient even for large vessels. However, in order to establish this with complete certainty, and to discover the most convenient channel for navigation, much more complete hydrographical surveys are required than those which we had an opportunity of making in passing.

As I have already mentioned, productive potato land and cabbage plots are to be found at the Skoptists' Colony, north of the Arctic circle, and the farther south we came, the more such patches of cultivation increased in size. No proper cultivation of grain is met with until we reach Sykobatka, situated in lat. 60°, but in the future it is quite certain that *when the woods and morasses are diminished*, a profitable agriculture may be carried on much farther north. Already from this point to the southern boundary of Siberia, or more correctly to the *steppe* lands of Central Asia, we have at most places more than 100 Swedish miles (1,000 kilometres), and if we consider that a belt of land of this breadth, for the most part covered with excellent, easily cultivated soil, extends right across the whole of Asia from Ural to the Pacific Ocean, we may form an idea of the immeasurable field of conquest for the plough of the cultivator which these regions offer, and the future which some time must open up for it.

Immediately south of Sykobatka we passed the church village Nasimowskoi, and a deserted gold-washer's "residence" lying right opposite, named after the first conqueror of Siberia, Jermakova. The "residence" originated in the discovery of beds of sand rich in gold in the pretty extensive territory of a tributary of Jenisei on the east of that river, which before the Californian discovery was renowned as the richest gold district of the globe. In a short time many colossal fortunes were made here, and the stories of the hundreds of *pouds* which one or another yearly washed, and the reckless, riotous mode of life of those whom fortune allowed to win the great prizes in the gold-washing lottery, still forms a favourite subject of conversation in the region. Heightened rates of labour and diminished supplies of the noble metal have, however, of late, led to the abandonment of a number of the washings which formerly were most profitable, and the others scarce pay for the working. Many of the gold washers who were formerly rich, have, in the attempt to increase their wealth, been ruined, and disappeared; and others who succeeded in retaining their *poud* of gold—that is the mint-unit that the gold washers prefer to employ in conversation—have removed to Paris, Petersburg, Moscow, Omsk, Krasnöjarsk, &c. All the "residences" are therefore now deserted, and form on the eastern bank of the river a row of half-decayed wooden ruins surrounded by young trees, after the disappearance of which in a short time only the tradition of the former era of prosperity will be found remaining. In one respect, however, these gold-washers have exercised a lasting influence on the future of the country; for it was through them that the first pioneers were spread in this desolate land, the first seed sown of the cultivation of the region.

At many places along the river there is to be seen besides another peculiar memorial chiefly from the time when thousands of labourers were collected at the gold-washings, viz., colossal flat-bottomed boxes formed of logs, which are here called "barks," which lie drawn up on the banks, more or less decayed. They were used for the transport of the necessaries of life on the river from Southern Siberia, and an idea may be formed of the calm flow of the Siberian rivers and their suitableness for water communication, from the fact that in this way goods were transported as far as the most northerly "simovies" on the Jenisei, on the main river, from regions situated south of Minusinsk, near the Chinese frontier and along its tributary the Angara from Lake Baikal; in fact, still farther, for even the river Selenga, which falls into Lake Baikal from the south, is navigable for a good part of its course. In order, however, to sail up these rivers from Jeniseisk there are required, as I have stated before, some operations for clearing the channel, but they are inconsiderable in comparison with the importance of the object. "Barks" of average size, built for the carriage of grain from Minusinsk, cost 300 roubles, load up to 130 tons, and are managed during the voyage down the river by fifteen men. After reaching their destination they are sold, in case a buyer can be found, for a few roubles. Notwithstanding their awkward shape they are well adapted for the river communication in question, and they would be still more so if during the down voyage of a considerable train formed of twenty or thirty of such craft, a small steam-tug could be had like those that are employed in the Archipelago of Stockholm. In this way the crew on each "bark" might be reduced to one-third; and the freight, which is already low, be farther reduced.

Since Sept. 20 night frosts had often occurred, which naturally considerably diminished the results of our excursions at the steamer's stopping places. We became therefore more impatient to reach our nearest destination. The strong current and the frequent stoppages delayed our journey, so that it was not until Sept. 30 that we could anchor at the town Jeniseisk. Here we stayed some days for the purpose of getting news from Europe, examining the fine collections made in several branches of natural history by Herr M. Marks, an exile, and settling our affairs; in connection with which I ought specially to mention that the owner of the *Alexander*, Herr Balangin, declined to receive any payment for our long voyage in the steamer, on which I made over instead, as a memorial to him and the excellent master of the steamer, Herr Jarmenieff, the Nordland boat, in which we began our river journey, and which had afterwards been brought hither in tow.

We then proceeded on our return journey by land through Krosnojarsk, Tomsk, Omsk, Tjumen, Ekatarineburg, Tagilsk, Perm, Kasan, Nischni-Novgorod, Moscow, Petersburg, and Helsinfors to Abo, and thence by steamer to Stockholm.

With the exception of some short stoppages in the large towns we travelled day and night, and a sketch of this latter part of our journey would therefore be occupied principally with the agreeable and friendly reception which we uniformly met with, and the interest which was universally felt in our polar journey. The correspondence which has appeared on this subject in the newspapers may perhaps free me from the obligation of saying more on this subject.

Before I finish this letter I ought finally to mention that the large collections in natural history made by the expedition both in Novaya Zemlya and the Kara Sea, and during our river journey on Jenisei, all, with the exception of a large collection of fish from Siberia sent by caravan, have come to hand in good

condition. For the examination and description of these collections I wish to employ the younger scientific men of eminence in our country, and as the most of them cannot without too great a sacrifice undertake year-long labours more or less foreign to their proper employment, I have made an application to the Government for a grant of 10,000 crowns (about 550*l.*) to defray the expense of working up the collections. If this application be granted, and the collections of the expedition of 1875 thus become not a dead museum-material, but fructify for the purposes of science, I hope that the sea visited by the expedition, formerly almost unknown, will soon be reckoned among those of our globe which are well known in respect of their natural history.

Part of these scientific researches besides concern purely practical questions, and I shall therefore, as they are concluded, give you a short account of them.

A. E. NORDENSKJÖLD

ON THE SPECTRUM OF NITROGEN AND THAT OF ALKALINE METALS IN GEISSLER TUBES, BY M. SALET

IN 1872 Mr. Schuster published the important statement that "nitrogen, heated in a Geissler tube with metallic sodium, ceased to give the characteristic channelled spectrum." He described the bright lines he got in this case, and attributed them to pure nitrogen, considering the band spectrum to be that of an oxide of nitrogen, a compound destroyed by the alkaline metal. These conclusions were afterwards disputed, for, in repetition of the experiments, the channelled spectra were seen to disappear after action of the sodium, but they were replaced by various spectra, none of which belonged to nitrogen; so that, after its purification, this gas could not be detected by prismatic analysis. The chemical compound really formed by the action of oxygen on nitrogen is (as M. Salet pointed out) peroxide of nitrogen, a very stable substance, whose spectrum does not coincide with that, the appearance of which is to be explained.

In a recent note to the French Academy, M. Salet affirms (1) that the channelled spectrum may be produced with nitrogen heated in contact with sodium; (2) that the disappearance of the nitrogen spectrum is due to that of the nitrogen itself, which is entirely absorbed by the sodium under the influence of the electric discharge; (3) that the spectrum described by Mr. Schuster may probably be attributed to vapours of the alkaline metal.

He describes some of his more decisive experiments. A closed tube of hard glass was procured, 12 cm. long and 2 cm. in diameter; at one end were introduced two aluminium electrodes, about 1 cm. apart; to the other end was soldered a tubulure with an enlarged part, into which was put a small piece of sodium, then the tubulure soldered to the mercury pump. A vacuum having been made, the sodium was heated; it swelled and boiled, parting with hydrogen; the swelling at length ceased, and at a higher temperature the sodium was slowly volatilised. Then the apparatus was separated from the pump, with the blowpipe; and the bright liquid and globule of sodium was brought into the tube. After cooling, the enlarged part was separated, and the tube directly fused on to the pump. Then exhaustion was recommenced, and the sodium volatilised, care being taken that the condensation of the metallic vapour occurred only in the half of the tube not holding the electrodes; and nitrogen, pure and dry, was then admitted. A vacuum was produced anew three times with the nitrogen, the alkaline metal being volatilised each time. Lastly, the apparatus was closed, having a pressure of about 5 mm. It was now possible to fuse the globules, unite them, and volatilise them afresh a dozen times in contact with the same mass of gas, without the appearance of the spark between the electrodes being in the least degree modified. The Holtz machine was used, or an induction coil with a Leyden jar; the interpolar space was roseate violet, and gave the channelled spectrum with the greatest distinctness. When the disruptive spark of the Holtz machine is employed, the jet of roseate violet light giving the channelled spectrum is instantaneous, as can be shown by a simple method (which M. Salet described). By volatilisation the sodium may easily be brought to the neighbourhood of the electrode. It there appears in the form of brilliant globules of a very pure silver white; but if the tube be set in action, the portions subjected to the action of the luminous discharge are at once tarnished. The metallic surface quite disappears, and is replaced by a brownish black. At the same time one sees in the appearance of the electric jet changes produced which are caused by a greater rarefaction. If the surface of the sodium be renewed the action continues, and the spectrum of nitrogen presently quite disappears; the light is yellowish, and due, for the most part, to sodium; there are, in general, slight impurities (from the electrodes and glass), which give some strange lines.

M. Salet made a direct experiment to show this absorption of nitrogen by sodium under the influence of electricity. He made a tube like the one that has been described, but bearing a truncated barometer; and introduced nitrogen at a pressure of 27 mm. The absorption of the gas was sufficient for one to be able to follow with the eye the ascent of the mercurial column. After a few minutes, having twice renewed the surface of the sodium, no difference could be perceived between the mercury surfaces in the two branches of the manometer.

The author also sought to characterise this absorption chemically. He broke a tube and treated separately with water a portion of the sodium remaining bright and a portion of the sodium altered by electricity. Into the solution he poured Nessler's test. One of the two liquids was strongly coloured yellow; it was that containing the altered sodium, the other was not altered in aspect. There was formed, then, under the influence of electricity, nitride of sodium decomposable by water with production of ammonia. This body is formed only at a temperature higher than red, like nitride of magnesium; or even is not produced directly at any degree of heat, like ammonia. M. Salet proposes to prepare and analyse it.

NOTES

WE hear with regret that the publications of the Geological Survey of the Territories by Prof. Hayden are likely to be stopped by the partisans of rigid economy in the U.S. House of Representatives. If this step be carried out it will be a serious loss to the scientific men of Europe, as well as of America. The discoveries which have been made by the staff under Prof. Hayden's direction are of the highest value, both from a scientific and a commercial point of view, and the liberality with which they have been circulated in Europe by the American Government has earned the gratitude of all who care for the advancement of knowledge. We trust that the rumour is untrue. If it be true, we hope that a voice of remonstrance will go forth from Europe. The possibility of a political change putting an end to a great national work like that of Prof. Hayden illustrates one of the worst flaws in the American Constitution, the cancelling of all Government appointments at the election of a new president.

M. LEVERRIER was not present at the Anniversary Meeting of the Astronomical Society to receive the medal which for a second time has been awarded him for his valuable Planetary Tables. Ill-health, caused by his recent great labours, was, we believe, the cause of his absence.

THE Annual Address of the President of the Geological Society will be given at the Anniversary Meeting to-morrow.

WE are gratified by the statement contained in the Queen's Speech, that the Government intend to introduce, in the course of the session, measures relating to Primary Education and the Universities. An important article on the subject appeared in Monday's *Daily News*, in which the defects of the present constitution of our Universities are forcibly pointed out. It is also shown how important a bearing the composition of the Commission would have in the character of its work, and that it would be but a proper act of deference to the valuable labours of the Science Commission if the new commissioners numbered some eminent representatives of science. What the direction of the proposed University reforms is likely to be may be to some extent gathered from the "inspired" hint dropped by the Dean of Christ Church, on Tuesday, in connection with the proposal to retain the services of Prof. Max Müller for Oxford. The Dean was authorised to state that

the Government "Universities" Bill would constitute an Executive Commission with powers to receive schemes from Colleges, and base upon them the new University and Collegiate organisation. We shall deal at length with this important subject at the proper time.

WE hear a rumour—which we think not unlikely to strengthen into a more certain sound—that the scheme for removing the Oxford Botanic Garden from its present historical and picturesque site to the bleak and arid "parks," has fallen through, and that immediate steps are to be taken to put the existing establishment on an efficient footing.

THE *Times'* correspondent, telegraphing from Rome on Tuesday, states that the Working Committee appointed by the Italian Government to act in concert with the General Committee in London for carrying into effect the exhibition of a loan collection of scientific instruments, to be opened at South Kensington in April next, have just addressed a circular to the various scientific institutions and individual *savans* throughout the country. It informs them that His Majesty's Government ardently desires that Italy should also take part in the Exhibition, and requests them to examine what instruments in their collections may be most worthy of being exhibited. It especially calls their attention to instruments of an historic character, and to those which have been constructed and principally applied in Italy. In the case of important instruments, of which the use cannot be dispensed with for the length of time the Exhibition may remain open, or which are of too fragile or too delicate a description to incur the risk of transport, but which, from their novelty or perfection, merit being brought before the notice of scientific men through this Exhibition, the Committee request that models and photographs of not too small a size may be sent. These models and photographs are to be made at the expense of the institution or persons exhibiting, but in cases where they may not be able to support the expense, the Committee, in proportion to the importance of the instruments, will supply the means from a fund set apart for the purpose by the Minister of Public Instruction. The Committee suggest that especial regard should be had to the quality and interest of the objects sent, rather than to the quantity.

A SUPPOSED error in the determination of the date when Easter Sunday should fall in the present year has been made the subject of communications to various metropolitan and provincial journals. We shall enter more fully into this question next week; meanwhile it may be stated that the presumed error is an imaginary one, according to the strict methods for ascertaining the date of Easter Sunday, which is correctly fixed by our almanacs to the 16th of April.

A COMMITTEE has been formed at the Hague for the purpose of organising a movement to erect a statue in that city to Spinoza, the 200th anniversary of whose death occurs this month next year. Foreign committees have also been formed, and among the members of the English committee are Professors Bain, Huxley, Jowett, Max Müller, Tyndall, Principal Tulloch, Messrs. G. H. Lewes and Herbert Spencer. Committees have also been formed in Germany, Austria, Belgium, the United States, Finland, France, Italy, and Switzerland. We do not require to say anything in favour of this movement; now that the matter has been mooted it seems surprising that nothing of this kind has hitherto been done to honour the memory of one of the greatest, purest, and most cosmopolitan of philosophers. The movement only requires to be widely known to meet with adequate practical support; many who may differ seriously from Spinoza's philosophy will be glad of an opportunity to show their appreciation of a great, courageous, and disinterested thinker. The treasurer is Mr. A. W. Jacobson, the Hague, the president being Dr. M. F. A. G. Campbell, of the same place.

AS regards our note in a former number on the Obi Expedition, we find that Dr. Finsch, of Bremen, whom we spoke of as about to accompany it, will himself be the conductor of it, and will be assisted by Dr. Brehm and Count Waldburg-Zeil, also the well-known microscopist Oscar Schmidt, of Strasburg. The Expedition is organised and sent out by the Verein für Deutsche Nordpolarfahrt in Bremen, and will proceed overland *viâ* Semipalatinsk and the Altai. It is expected to return late in the autumn.

WE are much pleased to see that Mr. E. L. Layard is gazetted to the Consulship of New Caledonia. In spite of the enormous pressure of business upon him during the late transfer of government in the Fiji Islands, Mr. Layard has managed to do a considerable amount of scientific work there; he has sent home large collections of birds, as well as several valuable papers.

WE have received a copy of the Statement by the Committee appointed by the British Association for the Advancement of Science for the purpose of continuing the investigation on the desirability of establishing a "close time" for the preservation of indigenous animals. Of the indirect and direct causes which tend to reduce the numbers of the Wild Fowl, which the "Statement" mostly concerns, the control of the latter of these causes forms its substance. It is shown that the ineffectual working of the "Wild Birds' Protection Act" depends on the insufficiency of the penalties imposed, the market value of Wild Fowl being high. It is also shown that as those who employ their time in the pursuit of these birds are in the habit of taking out a gun licence and of refraining from exercising their calling in certain waters and over certain lands, therefore they fully realise the nature of restraint, and would be willing—the better class of them, at least—gladly to recognise the propriety of a well-considered and stringent measure, which by effectually protecting Wild Fowl during the breeding season would secure to them a greater abundance at other times of the year. Whilst considering the protection of small birds as of minor importance, the Committee are of opinion that some steps for the regulation of bird-catchers might well be taken.

AT a congregation of Cambridge University on Feb. 3 the following grace passed the senate:—"That a grant of 50*l.* be made from the Worts Travelling Scholars' Fund to William Bridge, B.A., of Trinity College, to enable him to visit Naples, for the purpose of using Dr. Dohrn's Zoological Station, and making researches in Natural History, on the understanding that specimens be sent by him to the University, accompanied by reports which may be hereafter published."

AT the Royal Geographical Society on Monday last, Sir Henry Rawlinson intimated that Lieut. Cameron had solved the difficulty with regard to his followers, by purchasing a vessel at Loando for 1,000*l.*, in which they sailed early in January for the East Coast of Africa. By last accounts the explorer was still at Loando, whence he was to sail by the next steamer for Madeira. At the same meeting the Diary of the late Mr. Margary, from Hankow to Ta-li-fu, was read.

THE Council of the Society of Arts have appointed Mr. H. Trueman Wood as Assistant Secretary, under Mr. P. Le Neve Foster, Secretary of the Society. Mr. Wood has been for the last three years the editor of the Society's journal.

THE Senatus of the University of St. Andrews have conferred the degree of LL.D. on Mr. James Stuart, M.A., Professor of Mechanism and Applied Mechanics in Cambridge University, and on Mr. James Croll, of H.M. Geological Survey.

WE hear that ten days after the attempted ascent of Mont Blanc, noticed in our last number, an American lady ascended not only to the Grand Mulets, but to the summit itself, when

the temperature was — 25°. She reached the top on Jan. 31 at three o'clock in the afternoon, when the sun lighted up an immense panorama. The thermometer marked at the Grand Mulets — 13° and the Grand Plateau — 19°. The lady had with her several guides, and slept at the Grand Mulets on the evening of Jan. 31, returning by La Vallée on Feb. 1. She was enthusiastically welcomed by the inhabitants of Chamounix.

ONE of the Exhibitions granted to Cambridge University by the Worshipful Company of Clothworkers to be awarded to Non-Collegiate Students for proficiency in Physical Science, has been gained by Alexander Scott, educated at the University of Edinburgh. It is of the annual value of 50*l.*, and is tenable for three years.

AN open scholarship in Natural Science, of the yearly value of 90*l.*, tenable for five years, will be competed for at Queen's College, Oxford, on April 25, and following days. Candidates should signify, as early as may be in March, to the Provost, their intention of standing.

THERE are 616 boys now on the school-list at University College School.

WE are glad to see that an influential movement is on foot to form a Bristol and Gloucestershire Archæological Society. Such a society will have a fertile field for varied work in Gloucestershire, and we have no doubt, from the names which are identified with the movement, that the Society, when formed, will produce valuable results. The inaugural meeting will be held some time during the Easter holidays.

IT is proposed to open a school for field and laboratory instruction in Geology early in July, under the auspices of the Cornell University, at Ithaca, New York. The methods of instruction will be essentially the same as heretofore successfully employed at Penikese, Cleveland, and Peoria in the study of zoology and botany. The first and last quarters of the session will be spent at Ithaca, in laboratory work in connection with frequent lectures. About one-half of the session (second and third quarters) will be devoted to field work, with headquarters in an encampment in a mountainous region chosen for its fitness in illustrating geological structure. Prof. Theo. B. Comstock will have charge of this school. Similar schools with local field work where required are being organised under the direction of the professors in charge of the departments of physics, chemistry, botany, zoology, and free-hand drawing in Cornell University.

THE following College Lectures in the Natural Sciences will be given at Cambridge during the Lent Term:—Gonville and Caius College: On Anatomy and Physiology, by Dr. Bradbury; On Non-Metallic Elements, by Mr. Apjohn.—Christ's College: On the Physiology of the Senses, by Mr. H. N. Martin.—St. John's College: On Elementary Chemistry, by Mr. Main; Instruction in Practical Chemistry will also be given; on Palæontology (the Annuloida and Annulosa), by Mr. Bonney; on Physical Geology, by Mr. Bonney; on Elementary Geology, by Mr. Bonney.—Trinity College: On Sound and Light, by Mr. Trotter; on Electricity and Magnetism (Elementary Course), by Mr. Trotter; Practical Physiology and Histology, by the Trinity Prælector in Physiology (Dr. Michael Foster).—Sidney Sussex College: On Botany (Vegetable Histology and Physiology), by Mr. Hicks.—Downing College: On Physiology (Papers and Catechetical Lectures, with special reference to the Natural Science Tripos and the Second M.B. Examination), by Dr. Bradbury. On Chemistry (Papers and Catechetical Lectures), by Mr. Lewis.

A LAUDABLE scheme is on foot to unite the local societies of Cumberland into an Association for the Advancement of Science and Literature, having for its objects the spread of culture, mutual assistance in the organising of lecture courses, &c., wholesome emulation among the constituent societies in the production of original papers, a yearly union in some town of Cumberland for the reading of original papers and discussion of subjects affecting the scientific and literary welfare of the community, and the publication, at the expense of the Association, of those original papers brought before the various societies which may be considered worthy by the Council.

THE *Iowa Weather Review*, No. 3, gives a brief *résumé* of the weather during each of the six decades of October and November last. Among the more interesting points noted are the occurrence of the Indian summer from the 18th to 24th October; the entire absence of snow or rain from the greater part of the State during November, and a rapid fall of temperature with a N.W. wind on the afternoon of the 28th November, amounting to upwards of 40° in twelve hours. The meteorological year, ending with November, was 3°·8 colder than the average, and Dr. Hinrichs, judging from the sequences of the weather during the past thirty-five years, ventured to predict a mild winter in Iowa. It appears from an examination of cyclones traced over Iowa that electrical phenomena manifest themselves at a considerable distance from the centre of the cyclone, a point of some interest to meteorologists, and deserving of further examination. A table showing the rainfall at sixty-five stations in the state, and another table giving the various meteorological averages at Iowa City during the past four years, complete this very interesting number.

IOWA being the only state in the Union having a meteorological system of its own reporting to a central office and furnishing state reports to the press, it has been resolved to exhibit at the Philadelphia Exhibition specimen schedules, books, postal cards, manuscript weather maps, publications, and diagrams of the climate of the State, in order to show the working of the Iowa Volunteer Weather Stations. It being manifestly beyond the resources even of the munificently supported meteorological system of the United States to undertake the investigation of many important inquiries, other states will probably be induced to follow the example of Iowa when the system there pursued is fully brought under their notice at Philadelphia.

IN a report to the Secretary of the Board of Regents, the erection of a physical observatory at the Iowa State University has been recommended. The detailed drawings on which the estimate of the sum required is based, show that the different storeys of the buildings are to be appropriated to a magnetic observatory, optical observatory and laboratory, self-registering meteorological instruments, and the keeping of records of observation, and a meteorological observatory, while on the roof will be placed a wind-vane, an anemometer, rain and snow gauges, and radiation thermometers.

THE Science and Art Department has issued a Catalogue of Apparatus for instruction in Practical Plane and Descriptive Geometry, Machine Construction and Drawing, Building Construction, Theoretical Mechanics, Applied Mechanics, and Steam, to the purchase of which the aid of 50 per cent. is given.

ACCORDING to letters received from Ternate by Prof. Parlatore, dated September last, from Dr. Beccari, we learn from the *Gardener's Chronicle*, that that adventurous traveller had discovered on Mount Arfak, in New Guinea, a Balanophora and an Araucaria, besides species of Vaccinium, Rhododendron, Podocarpus, Umbelliferæ, and a Drimys. We have merely these names to tantalise us, but they suggest a very interesting flora. From the same source we glean the following:—A School of Horticulture has been established at Copenhagen. There will be a national horticultural exhibition at Rome from May 6 to 14, the first of the kind that has taken place in that city.

THE additions to the Zoological Society's Gardens during the past week include three Burrowing Owls (*Pholeoptyrx cunicu-*

laria) from South America, presented by Mr. A. Q. Lumb; two Golden Pheasants (*Thaumalea picta*) from China, received in exchange; a Tuft-headed Deer (*Lophotragus michianus*) from China, the first living specimen sent to this country, a Chinese Water Deer (*Hydropotes inermis*), five Darwin's Pucras Pheasants (*Pucrasia darwini*) from China, deposited; a Blue-cheeked Barbet (*Megalæma asiatica*) from India, purchased.

SCIENTIFIC SERIALS

THE *American Journal of Science and Arts*, January.—This number commences with a paper of "Contributions to Meteorology," in which Prof. Loomis gives results derived from an examination of the United States weather maps and from other sources. Among the points observed are: that periods of unusual cold are generally accompanied by descent of air from the upper regions of the atmosphere, and they are almost quite independent of direction of the wind; that both in summer and winter the force of vapour in Philadelphia is greatest with the wind which brings the highest temperature, and conversely; that the rainfall there shows a diurnal maximum about 6 P.M. and a minimum about 3 A.M.; that in the northern hemisphere storms increase in frequency as we proceed northward as far as latitude 60°, and perhaps somewhat further; and that storms travel with less velocity over the Atlantic (19·6 miles an hour) than over the continents of America and Europe (26 miles an hour). The author compares storm-paths in America and Europe.—Mr. Rowland continues his "Studies on Magnetic Distribution," and one result he arrives at is, that hardening is most useful for short magnets; in very long bars it does not increase the total quantity of magnetism, but only changes the distribution. It would seem that almost the only use in hardening magnets at all is to concentrate the magnetism and reduce the weight.—This paper is followed by a useful summary and comparison of recent researches on Sound by Tyndall, Henry, and Duane.—Prof. Draper endeavours to determine the correction to be applied for effect of temperature on the power of solutions of quinine to rotate polarised light. The presence of sulphuric acid changes the rotation power of the alkaloid by 100°. Quinine used to be given in the form of sulphuric acid solution, and in the recently more popular form of pills or the like, its action is much less, and less certain; this difference being doubtless due to the change of molecular arrangement which is revealed in action of sulphate solutions of the alkaloid on light.—Mr. Allen has a note on extinct wolf and deer species from the lead regions of the Upper Mississippi.

Foggendorff's Annalen der Physik und Chemie. Ergänzung. Band vii. Stück 1.—In a paper in this number on the mechanism of magnetic induction, M. Chwolson deals with a phenomenon in production of the magnetic state by external magnetising force, with which theory has seemed to be in discordance. This is the fact, that K, the so-called magnetisation number (or the ratio of magnetic movement produced to the magnetising force), in the case of small increasing forces, increases at the beginning, reaches a maximum, and with further increase of the force, becomes continuously smaller. This initial increase of K seemed to contradict the theory of molecular magnets capable of being turned round. M. Chwolson's object is to show that it not only does not contradict it, but is directly deducible from it, and he arrives at this result from a closer study of the processes which, according to Weber's fundamental hypothesis, must occur in a magnetised body, and from a simple assumption as to the origin of molecule-repelling force.—There are three (largely mathematical) papers in this number relating to the mechanical theory of heat; we merely give the titles:—On temperature and odiabata, by M. von Oettingen; On the specific heat and true heat capacity of bodies, by M. Herrmann; and On the second principle of the mechanical theory of heat deduced from the first, by M. Sjilz.—M. Voigt contributes the first portion of a careful investigation of the constants of elasticity of rock salt; he here treats the case of bending.

Der Naturforscher, Dec. 1875.—In this number we may note some researches by M. Fleck, of Dresden, which appear to damp recent optimism in reference to salicylic acid as a means of disinfection. He finds that carbolic and salicylic acids may, under certain circumstances, even accelerate fermentation. Benzoic acid is more effective against fermentation, and cinnamic acid still better; but their small solubility in water is against their use. The antifermentative action of benzoic, carbolic, and salicylic acids is dependent on the quantity of nitrogenous yeast-food; with increase of this the value of their action diminishes. The acids are not specific yeast poisons. Some experiments by MM. Kolbe and Mayer have a similar bearing.—From observations made during the German North Polar Expedition, it is shown by Dr. Hann that the density of the sea-water increases both at the surface and at 900 feet depth, with the latitude, and is in the Polar seas considerably greater than in the Tropics. Hence Dr. Hann concludes that a temperature-compensation of the water of the ocean by unequal proportions of salt does not exist; the heavy Polar water must therefore have a tendency to flow towards the equator.—In an interesting paper on the rate of propagation of excitation in sensitive nerves, M. Bloch shows that the methods for measuring this, which depend on the will of the experimenter (making a signal), are unreliable. He describes an ingenious new method; and he finds the velocity in the spinal cord 194 metres per second, while in the nerves it is only 132 metres per second.—There is an abstract of recent researches by M. Exner, which go to prove, in opposition to M. Edlund, that the supposition of a special power of expansion by the galvanic current in a metallic wire is unwarranted.—We further note some instructive researches by M. Stefan on the comparative power of heat conduction of different gases.

SOCIETIES AND ACADEMIES

LONDON

Linnean Society, Feb. 3.—Dr. G. J. Allman, F.R.S., president, in the chair.—William Hillhouse, Prof. E. R. Lankester, Daniel Pigeon, and David Robertson were elected Fellows of the Society. The following were proposed as Foreign members: Dr. Nylander, Professor of Botany, Helsingfors, and J. V. Barboza du Bocage, Direc. Roy. Zool. Mus., Lisbon.—Mr. Algernon Peckover exhibited a case of insects from Madagascar, collected by Mr. Kingdon. Among these Mr. Butler pointed out and made remarks on the scarce and remarkable *Actias Idae* of Felder's "Reise der Novara," the new Hawk-Moth, *Diodosida* sp., allied to a Congo species, also *D. fumosa*, Wallace, the *Danais chrysippus*, L., and its mimic, *Diadema misippus*, L., likewise a Homopterous genus allied to *Coomoscarta*, of Stäl.—Mr. Henry Trimen read a note on *Bœa commersonii*, R.Br. He observed that the supposition of Commerson having obtained the type at Magellan Straits is founded on an error; Mr. Rob. Brown regarded it as belonging to the Seychelles. Mr. C. Walter has quite lately discovered specimens growing on coral cliffs in the Duke of York's Island, which, through the Baron von Müeller, of Melbourne, have been forwarded to this country for identification. The probability is that Commerson himself obtained his examples in 1768 from the same locality; its true habitat afterwards having been confounded from the name "Praslin," attached to the original specimen, being given to widely different places.—Mr. Bowdler Sharpe read a paper on the geographical distribution of the vultures (Vulturidæ). These he divides into two sub-families Vulturinæ, with six genera, and Sarcorhamphinæ, with four genera, the distinctive characters and geographical range of which were commented on. The author likewise sketched out the classification of the birds of prey, as proposed by him in recent publications.—A short paper on New British Lichens, by the Rev. W. A. Leighton, was taken as read; in this six new species are described and figured.—The Rev. J. M. Crombie made some observations on two communications laid by him before the Society, viz., (1) *Lichenes capenses*, being an enumeration of the lichens collected at the Cape of Good Hope, by the Rev. A. E. Eaton, during the Venus Transit Expedition in 1874. (2) *Lichenes Kerguleni*, being an enumeration of the lichens collected in Kerguelen Land by the Rev. A. E. Eaton during the Venus Transit Expedition in 1874-5.

Mathematical Society, Feb. 10.—Prof. H. J. S. Smith, F.R.S., president, in the chair.—Messrs. A. Cockshott and R. T. Wright were proposed for election. The Secretary communicated a paper by Prof. Wolstenholme: Loci connected with the rectangular hyperbola, being inverse, with respect to its centres and vertices. Mr. Cotterill spoke upon the subject, referring to authors who had also treated of the loci in question.—Mr. W. Spottiswoode, F.R.S., read a paper on determinants of alternate numbers. The paper was founded on some unpublished notes on determinants and other functions of these numbers, communicated to the author by Prof. Clifford.—Mr.

Glaisher gave a brief sketch of a note by Mr. T. Muir, on the transformation of Gauss' hypergeometric series into a continued fraction.—The Chairman then dwelt in some detail on the partition of geometrical curves, the principal theorem being that, if D is the deficiency, the maximum number of distinct parts of the curve is D + 1. Professors Cayley and Clifford and Mr. S. Roberts took part in the discussion upon the paper.—Mr. J. Hammond gave an account of his paper on the sums of the products of r different terms of a series.—Prof. Clifford made a few remarks on pendular motion, in continuation of his paper read at the preceding meeting of the Society.—The President read part of a one-paged note on the pan-imaginary theory, by the Comte Léopold Hugo.

Royal Astronomical Society.—The Annual General Meeting was held at the Society's Rooms, Burlington House, on the afternoon of Friday, Feb. 11, Prof. Adams, president, in the chair.—Amongst the lives of deceased Fellows given in the Annual Report were those of Mr. Carrington, Prof. Selwyn, Mr. Vignoles, and Sir Edward Ryan; and amongst the deceased Associates were Prof. Argelander, M. D'Arrest, and M. Mathieu. Mr. Carrington has left the Society a legacy of 2,000*l*. He for many years served as secretary, and during that period published two important works, the one upon sunspots, and the other known as the Red-hill Catalogue of Circumpolar Stars. Mr. Carrington was the first to show the existence of the great drifts in the solar photosphere and to determine accurately the position of the sun's axis and the rotation periods of the various heliographic latitudes. After reading the Report of the Society, the President delivered his address upon the presentation of the Gold Medal to M. Leverrier for his investigations with reference to the perturbations of the outer planets.—The Astronomer Royal referred to Prof. Adams' address as one of a most exhaustive character, such as could only have been delivered by the Professor. The meeting then proceeded to the ballot for Officers and Council for the ensuing year, and the following gentlemen were declared to be elected:—President—Dr. Huggins. Vice-Presidents—Prof. J. C. Adams, Sir G. B. Airy, Mr. De la Rue, and Mr. Lassell. Treasurer—Mr. Whitbread. Secretaries—Mr. Dunkin and Mr. Ranyard. Foreign Secretary—Lord Lindsay. Council—Capt. Abney, Mr. Brett, Prof. Cayley, Mr. Christie, Mr. Glaisher, Mr. Knobel, Mr. Knott, Capt. Noble, Rev. S. J. Perry, Prof. Pritchard, Earl of Rosse, and Capt. Tupman.

Anthropological Institute, Feb. 8.—Col. A. Lane Fox, president, in the chair.—The President read his anniversary address, in which the papers read before the Institute during the past year were classified as follows:—Descriptive ethnology, nine papers; archæology, seventeen papers; ethnology, one paper; biology, three papers; comparative anatomy, four papers; psychology, one paper; sociology, two papers; philology, two papers. The remainder of the address was devoted to matters relating to the policy and internal affairs of the Institute. The Rev. W. Wyatt Gill read two papers on some traditions of the Harvey Islands, and demonstrated, by the assistance of genealogical tables of kings and priests, that the islands had not been inhabited more than about six centuries, and gave some instances from his own knowledge of canoes having drifted from very distant islands as a cause for the spread of the Polynesian race throughout the Pacific.—A paper by Mr. W. W. Wood, on some megalithic monuments in the Island of Rotumah was also read.

Physical Society, Feb. 12.—Annual General Meeting.—Prof. Gladstone, F.R.S., president, in the chair.—The following candidates were elected members of the Society:—Mr. W. R. Hodgkinson and Mr. H. M. Hastings.—The President read the report of the Council, of which the following is an abstract:—The Council points with satisfaction to the activity with which the work of the Society has been carried on during the year, as is shown by the number of papers read; and special reference is made to lectures which were delivered by M. Cornu, of Paris, and Mr. J. Norman Lockyer. The election of many distinguished physicists during the past year has given the Council much satisfaction, as it affords undoubted evidence of the progress of the Society and of the position it has now attained. The Society has to regret the loss of two members, Mr. Becker, who died on the 3rd of April, 1875, from bronchitis, in the fifty-fourth year of his age, and Mr. Waugh, who died on the 12th of October, from epilepsy, in his fortieth year. The Society has already published a work by Prof. Everett, on the Centimetre-Gramme-Second System of Units, and the Council is now in communication with the family of the late Sir Charles Wheatstone with a view to the publication of his papers. Attention is drawn to the benefit which the Society derives from the use of the lecture-room, &c., which were generously placed at its service by the Lords of the Committee of Council on Education. It has been considered desirable to arrange that the Council may grant admission to all meetings of a session to approved persons who are not members of the Society. In concluding the Council records its thanks for the services which Dr. Guthrie has rendered in his office of Demonstrator, an office which was formerly an important one in the Royal Society, and the Council believes that much might be gained if arrangements could be made for reproducing before this Society the experiments described in original papers which appear from time to time in this country and abroad. Several alterations in the Bye Laws were then discussed and adopted, and the following Officers and Council were elected for the ensuing year:—President, Prof. G. C. Foster, F.R.S. Vice-Presidents: Prof. W. G. Adams, F.R.S., and W. Spottiswoode, LL.D., F.R.S. Secretaries: A. W. Reinold, M.A., W. C. Roberts, F.R.S. Treasurer, Dr. E. Atkinson. Demonstrator, Dr. F. Guthrie, F.R.S. Other Members of Council: Latimer Clark, C.E., Prof. A. Dupré, F.R.S., W. Huggins, D.C.L., F.R.S., Prof. H. M'Leod, Dr. C. W. Siemens, D.C.L., F.R.S., Dr. H. Sprengel, Dr. W. H. Stone, Sir William Thomson, LL.D., F.R.S., Prof. W. C. Unwin, B.Sc., and E. O. W. Whitehouse. The proceedings then terminated with votes of thanks to the President, the Lords of the Committee of Council on Education, the Demonstrator, Secretaries, and Treasurer.

Geologists' Association, Feb. 4.—Mr. William Carruthers, F.R.S., president, in the chair.—On the drift of the North Wales border, by D. C. Davies, F.G.S.—The covering of drift is most complete on the eastern slopes of the border down to the plain of Cheshire and Salop. The greatest thickness is on a north and south line between Wrexham and Oswestry, the maximum of 150 feet being attained between Ruabon and Wrexham. The exceptions to this rule occur in certain hollows and valleys of the hilly region. The best exposures are at old Oswestry gravel-pit, 500 feet above level of sea, and the gravel ridge of Gresford. The author also gave a line of pit sections ranging from north to south. Five groups were described:—1. Deposits of the Pre-Glacial period, due principally to meteoric action upon adjacent rocks. 2. Stiff clay with boulders of local and northern origin, Lower Boulder clay. 3. Sands and gravels, with beds of mud and clay, Middle Glacial. 4. Stiff clay with boulders of local and northern origin, Upper Boulder clay. 5. Peat deposits, freshwater shell-beds, redistributed gravels, &c., Post-Glacial. The Upper Boulder clay (group 4) fills up inequalities in the preceding beds; it varies in thickness from 1 to 20 feet, in places thinning out altogether; the immense boulders which strew the surface come from this rather than from the Lower Boulder clay. Referring to these boulders generally, besides representatives of most of the Welsh rocks, and notably of the ashes, traps, and greenstones of Glyn Ceiriog, there are three principal varieties of "Scotch granite." The first deep red, with large crystals of red felspar; the second, pinkish, from an admixture of white quartz and red felspar, fine in the grain; the third is a greenish-grey rock, resembling specimens from Sutherland, Kirkcudbright, &c. A consideration of the phenomena presented by the three groups of the Glacial period leads the author to the following inferences:—1. The majority of the deposits are of local origin, being derived from the mountainous region of North Wales, then an archipelago of islands. 2. But, from the plentiful admixture of foreign matter, he infers a sea open to the north. 3. He insists upon the necessity of aqueous conditions: the coast would be partly ice-bound, but there was no general ice-cap. Besides the general alterations of level there were local alterations of level; proofs of this were to be seen in the neighbourhood of Oswestry, beyond which town the Scotch granites do not seem to pass. This the author considered due to currents deflecting the ice-rafts, &c. He concluded with an account of the redistribution of Glacial material in Post-Glacial time.—On the first Irish cave exploration, by G. S. Boulger, F.G.S. The author showed how the direction of the chambers of caves is influenced by joints, and drew attention to the distinction between caves and rock fissures as influencing their fauna. Unnecessary to assume that there was more carbonic acid in the air during the quaternary period, as water containing ·01 per cent. is the most efficient solvent of limestone, suggested that allowance might be made

for a fluvial period in considering the rate of deposition of stalagmite, and also for the influence of herbage in reducing the present amount of water percolating the rocks. The habits of beasts of prey and of aged animals frequenting caves was next considered. Shandon Cave, near Dungarven, was then described, and an account given of its excavation by Prof. Leith Adams and the author, during which remains of mammoth, reindeer, red-deer, wolf, fox, hare, goat, and various birds were found. The author concluded with some suggestions as to the state of Ireland and of its fauna during the period when these deposits took place.

Institution of Civil Engineers, Feb. 8.—Mr. Geo. Robt. Stephenson, president, in the chair.—The paper read was on Carlingford Lough and Greenore, by Mr. James Barton, M. Inst. C.E.

WATFORD

Natural History Society, Feb. 10.—Anniversary Meeting.—Mr. John Evans, F.R.S., president, in the chair.—The report of the Council and the Treasurer's account for 1875, showing that the Society was in a prosperous condition, were submitted to the members, and the President delivered an address on the work which had been done by the Society in the investigation of the natural history of Hertfordshire, and on the field of investigation open to the members.—Mr. John Evans, F.R.S., was elected president for the ensuing year.

VIENNA

Geological Society, Jan. 4.—The director, M. v. Hauer, read the anniversary report, describing the work of the Society in its various departments. During the last two years geological surveys have been continued in the Tyrol, in Galicia, and the Bukovina. In the Tyrol, Dr. Stache, with the assistance of M. Koch, and of two volunteers, M. Schranz and Dr. Posewitz, mapped the principal part of the Oetzthaler Mountains, and the Mountains of Tirol-Vorarlberg, forming the boundary of Switzerland, northward from the Ortler to the region of Balzers. At the same time M. Mojsisovics, with Dr. Hörnes and the volunteers, Dr. Reyer and Dr. Kotschy, completed the mapping of the region eastward from the porphyric massives near Botzen; northward to the Sexten and Puster valley; southward, including considerable parts of the Venetian Alps—as far as the line of dislocation near Primiero-Agordo-Zoldo; and in the east as far as the Piave; whilst M. Dölter made special investigations of the various eruptive rocks of the same region.—K. M. Paul, assisted by the Roumanian engineers, Const. Pilide and Const. Bottea, finished the detailed geological maps of the Bukovina, and in Galicia M. H. Wolf began the mapping on the eastern frontier of the country, between the Dniester southward, the line Siderow-Petlikowce northward, and the river Stry westward. On the whole 250 Austrian square miles have been mapped. Many other researches were carried on in almost all parts of the Empire. Among these are the following:—M. Stur examined the coal-mines of Bohemia, Moravia, and Silesia, for the purpose of making a detailed classification of their strata. By means of a grant that he obtained from the Urban-Schlönbach legacy, he was enabled to investigate and compare the large phyto-palæontological collections in Dresden, Halle, Berlin, and Breslau. Moreover, he visited chiefly on behalf of the museum of the Geological Society, some of the most important beds of Lias and Jura fossils in Salzburg and the Salz-Kamergut. The Ministry of Commerce, intending to establish a special school for workers in stone, commissioned the vice-director, M. F. Fötterle, to examine such rocks near Predazzo as might be used for technical purposes; this he did, and the school was opened on December 15, 1875. At the request of the same Ministry, M. H. Wolf made geological researches along the line of some railroads, and M. G. A. Koch along the recently planned Arlberg tunnel, &c. After a summary report of the labours performed by the committee for the geological investigation of Bohemia, and the Geological Society in Hungary, which had mapped 150 square miles of the south-western part of Hungary, in the last two years, M. v. Hauer proceeded to speak of the travels of members of the Geological Society and other Austrian geologists in foreign countries. He mentioned the labours of M. Stache in Tunis, of M. Tietze, lately returned from Persia, and of M. Lenz in the western part of Africa; from the last, a letter dated Lope in the Okando, July 28, 1875, arrived some days ago. To this place he had been conducted from Elimbareni by the old King Renoki, and he was going to pass through the dreaded regions of Oschebo (Mpangwe) in order to reach the Umbeke, and if possible the Mikaueke. "I shall try," Lenz writes, "to follow as far as possible a north-east direction; perhaps I shall succeed in reaching the upper course of the River Schari." Further, M. v. Hauer referred to Dr. Drasche, who intended to spend the winter on the Philippine Islands, and then to extend his investigations as far as Japan and Kamtschatka; also to the researches of Dr. Feistmantel in India. Finally, he gave a report of some expeditions sent from Vienna in the last two years to examine European Turkey and Greece. The work performed in the museum, the laboratory, and the study were not less successful than those in the field. In the museum have been newly arranged and classified according to their different zones, by M. D. Stur, the fossils of the Lias, Jura, and Tithon formations of the Northern Alps. This collection consists of 6,000 specimens under 1,214 numbers, found in 444 different localities; by M. Vacek have been arranged the neocomian fossils of the Northern Alps; by M. Hörnes, those of the tertiary from the Upper Danube and Vicenza. M. Stache completed the arrangement of the palæontological collections from Istria. In the course of the last two years the museum has received valuable presents in minerals, fossils, species of rock or worked stones from more than ninety institutions, offices, friends, and protectors of the Geological Society. The library has been augmented by 1,735 volumes and sheets. It contained, at the end of 1875, 20,971 volumes and sheets; 161 new folios were added to the collection of maps. In the laboratory there worked, besides the chief, M. v. Hauer, and the assistant, M. C. John, the volunteers Baron Jüptner, M. Schönfeld, and M. Mattesdorf. Many analyses were performed, especially of iron-stones, coals, cokes, &c., also of rocks. The collection of artificial crystals, a scientific treasure that no other museum or laboratory can show in nearly such abundance, has been again augmented materially, and comprises now more than 2,000 specimens. As to the publications of the Society, the *Verhandlungen* and the *Jahrbuch* appeared in regular course; from the Memoirs in quarto, five sheets, including fifty-nine single and sixteen double plates, were published. M. v. Hauer expresses his gratitude, in the name of the Geological Society, to the Minister, Dr. Stremayer, for the liberality and protection he always showed to it. He also refers to the many kindnesses bestowed on the Society and its members in the course of the past year, and concludes by expressing his lively gratification at the resolution taken by Government to establish new professorships for geology in the Universities of Prague, Graz, and Innsbruck.—Papers were then read by Dr. Stache on the geology of the environs of Tunis; by Dr. R. Hörnes on the recently-discovered horizon with *Bellerophon peregrinus* at the base of the triassic beds in the Alps of South Tyrol; and by Dr. Dölter on some minerals of South Tyrol.

BERLIN

German Chemical Society, Jan. 24.—A. W. Hofmann, president, in the chair.—R. Fittig has found amongst the products of distillation of citric acid an anhydride $C_8H_{10}O_3$ (boiling-point 242°) of a bibasic acid $C_8H_{12}O_4$, a polymeride of crotonic acid, to which he gives the name xeronic acid. This acid yields well-defined salts, but passes at once into its anhydride when liberated. The same chemist is investigating the question if non-saturated compounds have free affinities. He is inclined to answer this question affirmatively for the following reasons. Hydrosorbic acid $C_6H_{10}O_2$ absorbs easily HBr, yielding $C_6H_{11}BrO_2$ monobromo-capronic acid; pyroterebinic acid $C_6H_{10}O_2$ does not. Sorbic acid $C_9H_8O_2$ forms $C_6H_{10}Br_2O_2$ dibromocapronic acid. Fumaric acid $C_4H_4O_4$ absorbs HBr yielding monobromo-succinic acid at 100°; malsic acid $C_4H_4O_4$ is simply transferred into fumaric acid at ordinary temperatures by the action of HBr.—E. Fisher explains the action of nitrous acid on diethylurea, and described the first hydrazine of the fatty series obtained as follows:—

$$\begin{array}{ccccccc} C_2H_5{-}NH & & & & C_2H_5{-}N{-}NO & & \\ | & & & & | & & \\ CO & + & HNO_2 & = & H_2O & + & CO \\ | & & & & & & | \\ C_2H_5{-}NH & & & & & & C_2H_5{-}NH \end{array}$$

diethylurea — nitrous acid — nitroso-diethylurea.

The latter body diethyl-nitrox-urea, with iron and acetic acid

$$\begin{array}{l} C_2H_5N{-}NH_2HCl \\ | \\ CO \\ | \\ C_8H_4N{-}NH \end{array}$$

yields— which with HCl and water

yields ethylamine-chlorhydrate, carbonic-anhydride and ethyl-

hydrazine combined with two HCl: $C_2H_5NH—NH_2.2HCl$.—R. Benedich has introduced into pyrogallol both one and two molecules of ethyl, obtaining pyrogallic ethers by heating pyrogallol with ethyl-sulphate of potassium and caustic potash in closed vessels.—P. Marquart proves that commercial nitric acid contains iodine, and thinks that the violet reaction of sulphuret of carbon observed by Dr. Friedburg may be owing to this element. The latter chemist contradicts this supposition.—O. Döbner has transformed diphenyl-sulphurous acid $(C_6H_4)_2SO_3H$ into a piphenol $(C_6H_4)_2(OH)_2$, a dicarbonic acid $(C_6H_4)_2(CO_2H)_2$, and a dichloride $(C_6H_4)_2Cl_2$. The latter by oxidation passes into dichlorobenzoic acid, thus proving that the two atoms of chlorine, &c., are contained in the same C_6H_4 group.—R. Meyer has transformed aniline-salts into aniline-black by treating them with permanganate of potassium.—P. Claessen recommends hydrate of baryta, prepared in a peculiar manner, for absorbing carbonic anhydride in quantitative analysis; separated by cotton-wool, some chloride of calcium is put into the tube to keep back the water discharged in the process. Numerous analyses prove its exactness.—T. Griess has treated nitrate of diazobenzol with ferrocyanide of potassium, transforming it thereby by reduction into a new substance, $C_{18}H_{14}N_2 = (C_6H_5N)_2C_6H_4$, and into azobenzol. This interesting discovery is most likely already known to English chemists.

STOCKHOLM

Academy of Sciences, Jan. 12.—The Academy approved a report by a Committee, consisting of Herr Edlund and Rubenson, appointed to consider a proposal by the Board of Woods for establishing meteorological stations for the purpose of scientific arboriculture.—Herr Nordenskjöld gave a sketch of the scientific results of last summer's expedition to the Jenesei.—Herr Edlund communicated a paper entitled "Some Remarks on Galvanic Expansion," in which he gave a theoretical explanation of the fact discovered by him some years ago, that a metal wire, through which a galvanic current passes, expands to a greater extent than corresponds to the heating caused by the current. He then exhibited a specimen of the newly-published Tables of Logarithms, which had been calculated and printed by the calculating machine invented by Dr. Wiberg.—Herr Andersson gave an account of the contents of a report by Herr J. E. Zetterstedt, of a journey he had undertaken last summer, with a grant from the Academy, for the purpose of examining the flora, and especially the mosses, of the Silurian formation of Wester Götland.—The following papers were given in for insertion in the Academy's publications:—Contributions to the actinology of the Atlantic Ocean, by Dr. G. Lindström; Examinations of the nucleus, and the parts nearest to it, of the Comet of 1874, by Dr. N. C. Dunér, of the University of Lund; On Arionids and Limacinids in the zoological department of Riks Museum, by the Intendent A. W. Malm; Remarks on the fossil flora of Bjuf, in Scania, by Dr. A. G. Nathorst. From the results of preliminary researches, the author concludes that the deposit must belong to the Rhætic formation, as it contains *Palissya Braunii*, Endl., *Tæniopteris tenuinervis*, Brauns., *Pterophyllum acuminatum*, &c. He gives short notes on most of the species found, of which some have not hitherto been described. The locality has only two or three species in common with the flora at Polsjö, formerly described by the author, and he thinks that the fossiliferous beds at Bjuf represent a lower level, and most closely resemble those of Seinstedt.—On the reciprocal lines of force, by Dr. C. F. E. Björling, of Lund University.

PARIS

Academy of Sciences, Feb. 7.—M. Peligot in the chair.—The following papers were read:—On the chemical action produced by means of the discharges of an induction apparatus, by M. Becquerel. The effects are more marked than with the ordinary machine. With only two or four chromic acid couples, M. Becquerel obtained the reduction of copper, nickel, cobalt, &c., from paper moistened with their solutions. He also forms amalgams, following Davy's method.—Note on the metallic reductions produced in capillary spaces, by M. Becquerel. In organic nature, electro-capillary effects doubtless occur on rupture of vessels, *e.g.* of a vessel traversing a muscle. Here the blood is diffused and a coagulum is formed, which is in contact, on the one hand, with the blood; on the other, with the liquid moistening the muscle; hence a reducing or oxidising action, and the products formed may concur in closing of the aperture. M. Becquerel also explains the chemical reactions in capillary spaces when a voltaic couple is added.—On the formation of ethers, by M. Berthelot. He here studies ethyloxalic, methyloxalic, acetic, and nitric ethers.—Report on a memoir of M. Peaucellier relating to the conditions of stability of arches.—Memoir on approximation of the functions of very large numbers, and on an extensive class of developments in series (first part), by M. Darboux.—New geometrical properties of the surface of the wave, which are interpreted by optics, by M. Mannheim.—On left curves of the fourth order, by M. Serret.—On the tunnelling operations in Mount Saint Gothard (continued), by M. Colladon. The compressing pumps employed give double the effect of those used in Cenis, and are only half the cost, while they occupy, with their motors, six or seven times less space. Four turbines at Goschenen and Airolo work twelve pumps, and the air obtained at pressure of eight atmospheres is 1,000 cubic metres per hour. The pumps give 200 strokes per minute, night and day. The boring machines used are those of Dubois and François, Ferroux, MacKean, and Turrettini.—On the repartition of solar radiation at Montpellier during the year 1875, by M. Crova. The intensity of radiation is shown to reach maxima in spring and winter, and the coefficient of transmissibility in Herault, is found very considerable, exceeding sometimes 0·80 when the thickness already traversed is equal to 2.—On a new chloruretted propylene, by M. Reboul.—On difficulties connected with the preparation of pure aniline, by M. Rozenstiehl.—On the products of the action of chloride of lime on amines, by M. Tscherniak.—On granular conjunctivitis; *résumé* of two missions having for object the study of diseases of the eye in Algeria, by M. Gayal. The disease named is endemic in the region of the Tell and of Sahara. It is often developed through contagion with the secretion; and among local causes are the hot winds charged with sand, the solar reverberation, and the difference of temperature between day and night.—Crystallisation of meteoric waters, by M. Tissandier. In a drop of snow-water evaporated, a number of cross or dagger-shaped crystals are had; the form often taken by nitrate of ammonia in meteoric water. M. Tissandier tried in vain to reproduce such crystallisation artificially from dilute solutions of nitrate of ammonia; he always got crystals ramifying about a median line. He attributes the other form to presence of organic matters.—On the traces of dislocation presented by the tertiary formation in the valley of the Oise.

BOOKS RECEIVED

BRITISH.—Dr. Dobell's Reports on Diseases of the Chest. Vol. I, 1875 (Smith, Elder & Co.)—The Theory of Screws: Dr. R. S. Ball, F.R.S. (Hodges, Foster, and Co., Dublin).—Lessons from Nature: St. George Mivart, F.R.S. (John Murray).—Royle's Materia Medica. 6th edition. Edited by Dr. Harley (Churchill).—Cattle and Cattle-Breeding: Wm. M'Coombie, M.P. (Blackwood and Sons).—Excavations at the Kesslerloch: Conrad Merk (Longmans).—Marsden's International Numismata Orientalia: Part II. (Trübner and Co.)—The Native Races of the Pacific States of North America. Vol. V.: H. H. Bancroft (Longmans).—Reliquiæ Aquitanicæ: Lartet and Christie (Williams and Norgate).

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